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45p SEPTEMBER 8-14 Vol 1 No 27

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BBC ON THE BRAIN
Acorn speaks with a LISP: The AI language under Pro-Test

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Dragon rescue drama

By David Guest

The Dragon 32 was hauled back from the brink last week by a hastily assembled £2.5 million rescue package.

Dragon Data was baled out by its shareholders last Friday to stop the Dragon following the Newbrain into limbo. One of the UK's most popular micros, with sales estimated at 80,000 since its launch 12 months ago, the Dragon almost dragged its maker into the same cash-flow swamp that claimed Grundy Business Systems (*PCN, issue 26*).

According to Dragon its development plans for new systems will be unaffected and its move into the US will go ahead. But Tony Clarke, its managing director, has stepped down 'for personal reasons' and he will be replaced for the time being by an executive from the electronics giant GEC.

Dragon says its cash-flow problems came as a result of a fall in demand over the summer and the high cost of development of new products. These are the same symptoms that hit Grundy, but the Welsh micro maker expects to end the year in profit and it is dismissing last week's hurried fund-raising as no more than a normal side-effect of expansion in a competitive market.

To back this up it points to new areas of potential sales that it is opening up with new products. The disk drives were officially launched last week, and plenty of new software is on the way. At a date that Dragon will not name it hopes to launch more systems, possibly including a portable.

The £2.5 million package was put together by Prutec, the high-technology arm of the Prudential. Prutec has 42 per cent of Dragon, the Welsh Development Agency 23 per cent, and Mettoy 15.5 per cent — these are the major shareholders. It was Mettoy, the owner of the Dragon until last October, that sparked off the crisis last Friday.

Mettoy issued a statement that talked of a setback at Dragon as its own share price plunged. Before the end of the day the money had been produced and Dragon had issued a statement which described the cash as ensuring 'the company's financial stability'.

The episode could still prove to have been a storm in a tea-cup. But Dragon may be less ready to issue boastful sales targets — 300,000 by the end of 1983 — in the future, and the Dragon 32 may find itself under pressure in the market before the end of the year.

The price of the machine has already been cut once this year and Dragon claims that its share of the market has been constant. With prices generally still very volatile it may have to be cut again; a spokesman said: 'We would be in a position to respond should the need arise.'

Overstretched — too many Dragons for too few buyers this summer.

Over-reached — Dragon's move into sponsorship came when it could hardly afford it.

Over and out — former managing director Tony Clarke.

TONED DOWN — The latest product from the Epson stable, the FX100 printer, may not be blowing its own trumpet — it has a quiet mode option. Its printing speed is 160 cps and it comes with 3K input buffer, user-definable graphics, proportional spacing and an Italic font. Anyone wanting one should contact distributor Norbain Micro (0734 752201) in Reading. It should have this £655.50 model on its way to dealers soon.

Newbrain bid

By David Guest

Time is running out for the stricken Newbrain (*PCN, issue 26*).

The first signs of a rescue attempt appeared last week as a group of Newbrain dealers and ex-Grundy employees prepared to bid for the machine. But Grundy Business Systems, the would-be rescuers, and even High Street retailers agreed that time is not on the Newbrain's side.

The fear is that interest in the Newbrain in the shops will wane very quickly unless a good home can be found for it. Grundy finance director Tony Wheeler said: 'In terms of the product I'd be very optimistic about its future. But time is working against us. If anyone is to step in it has to be in the next few weeks — otherwise people will start moving away from it.'

He added: 'We are all working as far as we can to find a prospective purchaser. A number of people have expressed interest in buying the business.'

Mr Wheeler would not name any of these people, but the only would-be rescuer to reveal itself so far is interested not in the business but in the rights to the Newbrain. This is a consortium of dealers and individuals being organised by the Computer Traders Association (CTA), of which Grundy Business Systems was a member.

The CTA's Nigel Backhurst explained: 'It is a group of about 30 or 40, including some overseas dealers. The intention is that a new company will be formed to buy the rights to the Newbrain.'

If the group succeeded, the future of the Newbrain and the CP/M system — for which Grundy claims to have a substantial order book — could be assured, and existing machines would continue to be supported. But Mr Backhurst also stressed the need for speed: 'We expect Grundy to appoint a liquidator on September 8, we could start talking on the 12th, and we'd need an answer by the 23rd.'

A hint of what could happen to the Newbrain came last week from Lasky's, probably the country's biggest single outlet of Newbrains. If the Newbrain is orphaned, Mike O'Reardon, group computer manager for the London area, said: 'We will withdraw them and possibly sell them at a reduced price without back-up.'

Lasky's offers various guarantees and if the Newbrain goes under it may offer current Newbrain owners who bought their machines there some kind of trade-in. Either way, you should be safe; Mr O'Reardon said: 'We will carry spare parts for those units for the next five years.'

The fate of Grundy Business Systems should be decided at a creditors' meeting due to take place this morning (Thursday).

Humidity fade-out hits ZX paper

The summer has taken its toll on one of the most common accessories on the UK micro scene — paper for the ZX Printer.

The paper suffers from humidity — there may be no risk from the weather for the rest of the year but it will be a good idea to stay out of the greenhouse when you're looking for somewhere to store it.

Faded paper, according to Sinclair, is more often caused by humidity than by exposure to sunlight.

When questioned a Sinclair spokesman said: 'The paper should be used within 12 months of purchase. It photocopies well. I would therefore advise users to copy printouts which may be required at a later date, avoiding fading due to strong sunlight or deterioration of any kind.'

Security on soft menu

If you don't trust the 'normal' type of security for your data-files (the locks, keys and hidden places), then Lifeboat Associates may have the answer for you.

It has just launched a program called DES-Crypt, a software implementation of the Data Encryption Standard algorithm. This has been approved by the American Bureau of Standards as a safe and reliable way of keeping sensitive files safe from prying eyes.

DES is more often heard of as a hardware implementation and is available in chip form, but the new program offers the same level of security and is much cheaper.

DES-Crypt will be available to run under PC-DOS, MSDOS, and both 8- and 16-bit versions of CP/M.

Operating the program should be easy, since it's menu-driven, and as well as turning readable files into meaningless blocks of five characters (and being able to undo the process), it has options which allow the user to check that a file has been properly encrypted, as well as data-authentication and automatic key-generation.

It's aimed at the kind of professions where the data which is liable to be handled will be confidential or valuable — doctors, financial analysts, stockbrokers and the like — but every business will have sensitive data somewhere on the system.

The minimum memory required is 36K, and it will cost £105. It's available from Lifeboat on 01-836 9028

DR ikonography

By Ralph Bancroft

A universal software interface with windows and ikons, and CP/M on a chip are the two products chosen by Digital Research to spearhead its attack on the home computing market.

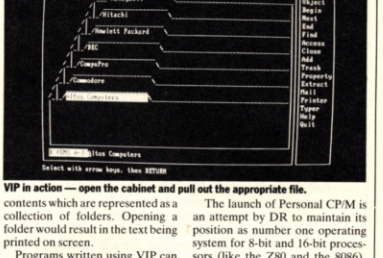
Visual Information Processor (VIP) is a software development tool that allows software companies to write programs with a common user interface. Written in the systems language C, it comes with a collection of link utilities that will allow the companies to adapt their programs within a matter of days to run on different machines.

DR claims that VIP will run on any of the processors used in home micros.

From the user's point of view programs that use VIP will have many of the benefits associated with Apple's expensive Lisa. The screen will be split into a series of windows. One carries the options available, which you can select using the space bar and return keys. A one-line prompt/command line at the bottom of the screen gives you information on what each option does.

The rest of the screen is used for either text or a visual representation of what the program is doing (called 'ikons' in Apple parlance).

As an example of how this could work, a database program might use a collection of filing cabinets to represent the database. Drawers can be opened to reveal their contents which are represented as a collection of folders. Opening a folder would result in the text being printed on screen.



VIP in action — open the cabinet and pull out the appropriate file.

Programs written using VIP can be integrated to allow the transfer of data from one program to another — so you could take a file from your spreadsheet program, edit it with a word processor and store the results in your database.

DR would not be drawn on how much VIP will cost the user. The intention is to license the 'soft technology' to the micro manufacturers, who would then sub-license VIP to software houses. Because the financial arrangements will vary from machine to machine the actual cost is difficult to pin down. However, it is thought likely that VIP will add around 50p to the cost of a typical program.

The launch of Personal CP/M is an attempt by DR to maintain its position as number one operating system for 8-bit and 16-bit processors (like the Z80 and the 8086). Putting it on a chip should lower the cost and avoid the need to load it from disk every time the micro is used.

It also avoids the more user-violent aspects of CP/M, such as its incomprehensible error messages. On powering up the machine, the user will be confronted by a menu of plain language commands, similar to that used by VIP.

DR's new products will be available by the end of the year and the company is already negotiating with manufacturers.

VIP and Personal CP/M are the first parts of DR's strategy to challenge its arch-rival Microsoft.

TI bargains

If you're saving up for the 16-bit TI99-4A micro, hold on to your crumpled fivers and wait until the end of September, when the price will fall from £150 to £99.95.

Some software has also taken a cut. Examples are Wumpus, down to £11.95 from £21.95; Connect 4, down to £14.95 from £21.95, and Multiplication, which will cost £19.95 instead of £31.95.

Software for the TI99-4A is being increased with the emphasis on computer literacy and secondary education up to 'O' level.

Twelve new cassette packs will join the present range at the end of the month at £9.95. These are being released by Collins Educational Publishing and Ivan Berg Software.

The Collins range includes Chess Learning and Record Keeping, while the Ivan Berg collection will mostly cater for secondary education with programs including Maths Tester, Physics, Chemistry and Biology.

Texas has no plans for further price-cuts. One-third off a leading product should keep the pot boiling for the time being.

Electron teletext break

By Geof Wheelwright

Sir Computers has taken an early lead in the race to provide peripherals for the new Acorn Electron.

Sir is releasing a teletext adapter for the £199 micro that will allow it to run BBC Micro programs using teletext Mode 7. This will be a great boon to Electron users, as the majority of BBC software uses Mode 7 for at least the title page — and without a teletext adapter the Mode 7 graphics are unreadable on the Electron.

The adapter will also allow you to download teletext software from the BBC's telesoftware service — giving you much the same facilities as Acorn's own teletext adapter for the BBC. Sir hopes to make it available by mid-October.

Sir's first Electron add-on, available in three weeks, will be a joystick and printer interface for £40. The printer interface will provide a BBC-style Centronics port with the full complement of BBC *FX calls to control and configure standard printers, while the joystick interface will contain an analogue to digital converter — enabling the use of the BBC Basic ADVAL command.

A working prototype of the joystick/printer interface was demonstrated at last week's Acorn User Show. The device plugs into the Electron's expansion port and is driven by software either on cassette or on an EPROM chip.

Sir (0222 21341) also announced the development of a plug-in ROM board for the Electron that will allow the new micro to use the same plug-in ROM software as the BBC.

Mayhem in a modem

The introduction of Micronet's hardwired modems for the BBC and Sinclair Spectrum computers is likely to send the cost of second-hand acoustic modems plummeting.

The expected price-drop will be led by people who bought acoustic modems for the BBC micro last spring and now find themselves wanting to upgrade to Micronet's £69.95 hardwired modem. The upgrade will be encouraged by Micronet's offer of free ROM software to any existing acoustic modem owner who buys the hard-wired version.

And those who do upgrade to a hardwired unit will probably want to get rid of their acoustic modems — which cost them slightly more than £50 last spring. In order to compete with Micronet — which still sells the acoustic modems new for only £60.10 (including Vat, post and packaging, software and Micronet registration on Prestel) — owners of acoustic modems will have to sell theirs for less.

That price will be pushed down even further by the fact that buyers of used modems will have to pay £15 for a Micronet registration for £20 for a one-year membership to Prestel.

The Spectrum modem is currently being offered at an introductory price of £74.95 including post, packing, jack-plug installation, and Micronet membership.

VIEW FROM JAPAN

Sightseeing in the micro emporium

by Serge Powell

Pick up just about any business magazine that makes it to this side of the world, and sooner or later you'll come across an article prophecying gloom and doom and the coming shake out in the computer market. In Japan, at least one maker that got shaken-out early has found a unique way to survive.

The company is Omron Teisai, a maker of minor IC products like digital alarm clocks. When it ventured into computer manufacturing it proved to be less than successful. The company quickly got out of other manufacturing and turned its Ginza office into a nine storey computer superstore to handle the products of those makers who still reckon there is a buck to be made in pumping out hardware.

The name of this electronic emporium is Micomdase, and in spite of, or maybe because of its high sounding name the staff selling the low-end product seemed to be up to the usual low standard of most computer retailers. For example, although samples of about 30 or 40 kinds of printer paper are displayed, the standard plain white both sides perforated samples aren't even stocked. If you wanted to buy it, it could, they assured me, be ordered, but the actual delivery date was a little uncertain. Nevertheless, it's a great place to go sightseeing.

Each of the floors has a special name and function—the ground floor is called Micom Joint Board and features a variety of games computers, like the Sord M5, the Tomy 16-bit Graphic Computer, Atari, plus a variety of marked down (40 to 50 per cent) PCs such as the Casio ST1100, which currently sells like hot cakes.

The second floor, or Hobby Life Board, offers a Smorgasbord of hand-held and pocket computers including Epson, Sharp, Canon and NEC's offerings. In one display alone I counted 18 different sizes and shapes of monitors. For reference, the Apple IIe+ was listed at Y358,000, the Silent-type printer at Y15,000 and the Apple Disk 2 went for Y199,000.

There was also a cosmetically attractive unit from Yamaha, and the accompanying brochure listed other models with prices that were attractive, particularly coming from a maker with no track record. Tucked under a counter were some Vic 1000s (Vic 20s), but the maker, Commodore, has abandoned retailing in this market, according to rumours.

Floor three is called Intellectual Board and naturally features magazines and software. As for magazines, try these names for size: I/O, ASCII, Micomlife, OH MZ (for Sharp), OH PC (dedicated to NEC), BOS, Trigger, Login, DIC, Astec, Interface, Information, Cursor, plus a couple called IBM something or other. All of these titles are printed in English.

Moving upwards we next hit System World Board. And above that Business Soft and Hard Board. These two floors are where you see your heavy duty 8 and 16 bit units from the established makers. The latter too rich for my blood, and technologically way beyond my Japanese, I glide silently among the printers, keyboards, drive units, modems and what have yous bathed in the pale light of the monitors displaying their incomprehensible rows of Kanji text spreadsheets and graphic displays.

I also say a firm thanks that the heady floors above me are by invitation only, and that the cupsie copywriter who named the floors below ran out of ideas. Above me are offices, Schools/Siminar, Techno-office/Decision Room and Club/Saloon.

Fortunately for the likes of me, this fifth floor also offers a coffee shop where I can pursue Micomdase's somewhat dated brochure. Among the models I have seen on display it tells me are one Apple, six Casios, one Epson, three Fujitsus, three Hitachis, IBM, one Mitsubishi, three Matsushitas, seven NECs, three Okis, one Olivetti, four Sanyos, eight Sharps, five Sords, two Toshibas and a partridge in a pear tree.

And it comes to mind that, for a former computer maker out to survive the coming shake out, Omron has done a pretty good job of hedging its bets.

Crystal sets

The greater importance of software over hardware was highlighted at the launch of the Crystal 68000 'micro' last week.

The new machine, which is a very large micro with pretensions (not unjustified) to being a mini, is based around a Pertec CPU card carrying a 68010 chip clocked at 10MHz, and can run several different operating systems.

It's assembled by Aston Technology, a new company which has its headquarters in the Aston Science Park, a venture intended to generate jobs and wealth by the use of new technology.

The system has a local area network which uses the RS232 serial standard in the R-series machines, but in the C-series there is a high-speed networking system, which uses co-axial (TV-type) cable to pass data to remote workstations at rates up to 250K bps. The maximum length of cable can be 20,000ft, and the size of a data-block can be up to 1K.

The Crystal Workstation is a Z80-based machine with either 16K or 64K memory, and apart from slotting into a multi-user system, it can also run a full CP/M 2.2.

Of course, Aston Technology would doubtless prefer customers to embrace one of the more up-market OSs which the machine will run, such as Unix, BOS, the Crystal OS or Pick.

This latter is the subject of a major promotion drive by the company.

The Crystal 68000 business system — the Aston Martin of micros?

Pick, which is deemed by its devotees to be the most sophisticated operating system so far developed, was written in the early '70s by Dick Pick as a 'no-compromise' system, and was originally used by the US Department of Defence to control the spare-parts file for the Cheyenne helicopter.

Besides Dartmouth Basic, the Crystal 68000 comes with a program called System Builder, which is designed to front-end Pick. This is claimed to offer the 'easiest to use and fastest development system . . . ever encountered.'

The machine comes in two styles, as a desktop unit and a floor-mounted cabinet, and prices start from £5,550.

Hobbit maker adds graphics for Spectrum

Melbourne House, creator of the top selling Hobbit program, has brought out a new package that allows Spectrum owners to generate their own impressive colour graphics.

Called 48K Melbourne Draw, it is based on the routines that Melbourne House developed to create the graphic effects used in its programs. It costs £8.95.

One particular feature of the program is its ability to enlarge or reduce an image. You can therefore enlarge a portion of the screen to create detailed pictures and then reduce it again to normal size.

You can also create personalised lettering anywhere on the screen and in any direction — including backwards and upside down.

Additional commands allow you to create user defined graphics, control and alter colours on the Spectrum and store graphics on cassette.

Melbourne House is on 01-405 6347.

Optic orders

It's too late to be first in the queue for a storage device that will give you 1,310Mb per side, but Hitachi is taking orders, and is promising shipments next April.

The Japanese giant has developed an optical disk storage system in conjunction with its subsidiary, Hitachi Maxell. The H-6975-1 is said to use a 12in optical disk with the astronomic capacity already mentioned. Besides data it can also be used to store text or illustrations, and according to Hitachi the average access time of the system is 250 milliseconds.

This drifts out to six seconds in Hitachi's optical library devices, in which 32 disks will offer mind-boggling capacities.

You won't be able to attach this kind of device to a Spectrum in the foreseeable future, but with deliveries due to begin next year they could be making a widespread impact, on services such as viewdata and pastimes such as arcade games, before the end of 1984.

Warranty is a home help

An extended warranty scheme will shortly be available for home computer users. The scheme is being set up by Astronics, a company formed to specialise in on-the-spot maintenance.

Most of the systems gracing the shelves of high street stores are sold with one year's warranty. It has been possible to buy home computers off the shelf for just over a year, and Astronics reckons it is now that owners will be feeling the pinch, as they reach into their pockets for the cost of repairs.

Insurance is one way of paying for breakdowns (*PCN, issue 19*). But David Evans of Astronics commented: 'As we repair equipment ourselves, the return time is much shorter, as paperwork accompanied by an insurance claim is not necessary.'

The warranties available will be for three or five years, not only for new equipment but also for items on which the maker's guarantee has expired. It costs £25 and £35 respectively, and will cover micros such as Commodore's Vic 20 and 64, the Dragon, the Lynx and the Oric.

Astronics is only interested in home micros. It will be happy to extend the warranty on the BBC, but not if it is being used for business purposes. 'We have maintenance contracts available for businesses,' said Mr Evans.

A W H Smith spokeswoman commented: 'We believe it will be welcomed by consumers and we are currently considering an extended warranty ourselves, although we do believe the greatest need is going to be for the more expensive hardware, because people are trading up to more sophisticated machines.'

The warranties will be available nationwide from micro dealers or direct from Astronics on (0705) 326223.

BUFFER STATE — To let you carry on using your micro while the printer is churning out hard copy, Microtechnik of West Germany has launched the Big Buffer, which has a capacity of up to 120K. The unit runs with parallel printers and can be powered from your printer or from an independent power source. It has a reset key, to clear its contents, and a monitor mode to let you inspect all codes sent from the system to the printer. It comes in five versions, from 8K to 120K; the prices, which include cables and connectors, run from $170 to $363. The company can be contacted on 010-49 202 510444.

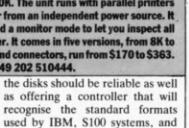
Zenith drives for its new machine

Additional storage for the Zenith Z-100 system (Pro-Tested in next week's *PCN*) is now available from Zenith in the form of half-height disk drives.

The drives will give you 1Mb per diskette and they come in single and double drive units. The 8in disks are double-sided, double density, and the single drive version can be up-graded to the dual on the spot.

Zenith's supplier is Shugart, so the disks should be reliable as well as offering a controller that will recognise the standard formats used by IBM, S100 systems, and CP/M-based micros.

The single drive model, the Z207-41, will cost £1,094 and the dual drive Z207-42 is £1,727.



Z-100 — now with half-height drives.

Multi-printer interface for DEC

Following hard on the heels of Midlectron (*PCN, issue 24*) and RTZ, TechSolv Products has released an interface unit that lets you use Qume, Diablo and Fujitsu daisywheel printers not just on the DEC Professional but on the entire DEC range of micros.

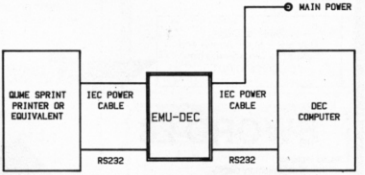
Harry Case, director of TechSolv in Reading, says the £172.50 device, called Emudec, consists of a 6in × 2in unit with its own Z80 processor inserted in the RS232 cable. You take the power in interface cables from the printer and plug them into the unit, which then plugs into the micro itself using two more cables.

The interface intercepts printer commands for the DEC LPQO2 daisywheel printer and changes them into commands suitable for a Qume Sprint printer or plug-compatible equivalent.

Midlectron has an interface card for making a DEC Professional work with an Epson printer and RTZ Computer Services has a financial planning package out with an interface serving the same purpose.

RTZ's package, Pro-FPS-80, has a starting price of £1,725 and you can only buy Midlectron's product if you buy an Epson printer at the same time.

The TechSolv unit is available now direct from TechSolv Products in Reading on (0734) 584239 until distribution outlets are set up.



Emudec puts the bits together to run a non-DEC printer from a DEC micro.

Price cuts for Oric users

Members of the Tangerine Users Group are in for a 50 per cent discount from the Oric specialist Kenema.

Hitherto this would have covered only software for the Oric 1, but Kenema is soon to launch its first hardware add-on for the system, namely a six-slot expansion system mother board.

The board incorporates the Main Bus Expansion, Parallel Printer Bus, RGB and Cassette/Sound Bus extensions. Kenema intends this to open a range.

It has also produced Oricstar, a word-processing package for which Kenema (0934 510279) claims full screen editing, string search and replacement, full printer support, word wrap, document and secondary text store files, and a mailshot retrieval system. Oricstar costs £12.

Fast French?

A psychological approach to language learning should be available in crash-course form for your micro before Christmas.

Seven software companies are to publish Dr Michael Gruneberg's innovative training courses, and between them they cover BBC, Dragon, Spectrum, Atari, Commodore, Oric and Lynx systems. The courses are for people who want to learn French, Spanish, Italian, or German.

Dr Gruneberg's method aims to give you a basic vocabulary of 300 or 400 words with the grammar to use them. He says that in 12 hours you can achieve what would take 40 hours with conventional methods. The courses are primarily for people who want to learn the basics of a language in a hurry, or for holidaymakers, or for children who find the whole process boring.

'The basic technique in acquiring the vocabulary is the use of imagery,' said Dr Gruneberg. 'This means linking the sounds of words in different languages.'

Computers, he added, are a particularly good medium for a course of this kind. 'The material is put up on the screen and patterns of testing and grammar are integrated with the vocabulary.'

Dr Gruneberg himself is a psychologist who speaks no foreign language beyond 'O' Level German. Expert linguists at the University College of Swansea verified his course material, but his primary interest is in the way people remember things and how their capacity can be increased.

The presentation of the courses is in the hands of the software houses which will publish them, but it is likely to comprise two program cassettes, an audio cassette, and a manual.

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* Flagging to show occurrences of a chosen byte value.
* Insert or delete cursor editing.
* Cursor position available as parameter for other commands.
* Status page shown on every command entry, including:
  * Address last under cursor (M).
  * Mnemonic and binary representation of byte at cursor.
  * Flag Search Value (S).
  * Label Address (L) — (destination for jump calculator).
  * Register display with condition code analysis.
* 8 breakpoints with contents, address and status.
* Cursor controlled register writing.
* Cursor selection of 8 breakpoints.
* Breakpoints can be positioned, activated and deactivated.
* Flag to show breakpoint caused last exit.
* Hold command to freeze screen after exit.
* Execution from typed-in address or cursor position.
* Block copy (move), also serving as Fill facility.
* Binary and Mnemonic code entry.
* Long and short relative displacement calculator.
* SWORD program is relocatable.
* Some Assembler and Disassembler facilites.

Prices shown include p&p

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All programs in this advert carry a 10-day money-back warranty — if you are disappointed in the programs send them back for a full refund!!!

Future stocks

Integrated portable systems for £450? Home computers for £35? These are some of the treats lying in store for micro buyers in four years' time, according to the research firm Frost and Sullivan.

'Two out of three microcomputers sold worldwide will be portable by 1987,' says the company. This doesn't mean that it will take the likes of Apple, IBM and Torch four years to fit a handle to their machines, but that the days of the static deskbound system are numbered.

Frost and Sullivan's study, *The Market and Competitive Environment for Portable Computers*, is based on the US. It looks at machines selling for between $400 and $10,000 that can be configured as battery-operated hand-held or lap systems, briefcase units, or integrated transportable systems.

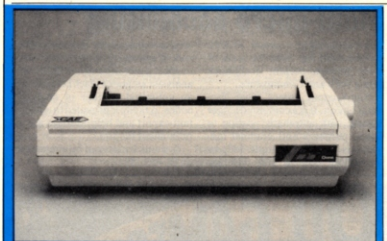
While prices plummet, sales — particularly of micros in the 25 to 40lbs range — are set to soar, it says. Machines like the Compaq (not yet available in the UK) and the Hyperion (from Gulfstream and Anderson Jacobson) are singled out as leaders of the boom, but the pressure on prices is likely to come mainly from systems such as the Kaypro range (distributed in the UK by CK Computers).

It estimates the current average price in this bracket as $2,089 (£1,350) and expects it to fall to £450 by 1987.

This is despite a tendency for retailers selling machines in the over-$1,000 range to stick to the list prices, leaving discounting to those who sell lower-priced systems. An encouraging sign is that they all identify a ceiling — beyond $4,000 products are 'too expensive for the market'.

Frost and Sullivan also spoke to users of 'a popular 8-bit integrated portable'. Almost half of these users said that low price was the main reason for their choice; bundled software came next, and portability was third — but it came out as the most liked feature.

The survey took little account of developing technology, but it's safe to assume that the performance and capacity of portable micros are likely to improve, and that weights may be reduced at the same time.



PRINTING PLUS — Daisywheel pioneer Qume has added a new printer to its Sprint line. The unit can be yours with an RS232, Centronics, IBM PC or IEEE-488 interface, so it will run with almost any micro you care to name. This kind of versatility doesn't come cheap — the Sprint II Plus has a price tag of £1,395 besides a name that will send shivers down the spines of older UK users. But to soften the blow Qume is claiming high reliability for the printer — 5,500 hours between repairs. There are two versions, giving 40 and 55 cps. Qume also has a 130 character wheel as an optional extra to give the printer a range of typefaces and alphabets. It is distributed in the UK by Teleprinter Equipment of Tring. For more information contact (01)-637 2281.

New TV stars are wanted

Midlands readers hankering after the bright lights are about to get a chance. Central Independent Television is making a six-part series about computers and requires a studio audience of seven to 16 year old computer enthusiasts.

Youngsters wishing to take part in this series should write to Geoffrey Negus, Central Independent Television, Central House, Broad Street, Birmingham B1 2JP. Your application should say which micro you own and include a brief description of what you do with it. You must also enclose a note from a parent/guardian giving consent for you to attend.

Don't despair if you don't have a micro. You may also apply, but you must include a description of why you would like to own one.

The recordings will be held in Birmingham on Sunday October 16, Sunday October 23, Wednesday November 2 and Monday November 7.

Cheshire Cat looks for the cream

Proving that microcomputing isn't exclusively a male preserve, three Cheshire housewives have got together with teachers and programmers to form a co-operative producing educational software.

The first product from Ampal Computer Services (056589 3563) is the Cheshire Cat series.

Intended for children from 5 to 18, the software includes maths programs from pre-school to 'O' Level History, 'O' Level Physics, beginners' computer programming in Basic and its big brother, Basic tutorial advanced level.

The programs use a game format in full colour, with the sound and graphics facilities provided by home computers such as the Dragon 32, the BBC and the Oric.

An example of this technique is Super Spy — a modern history simulation combining video game skill with teach-yourself history. You are parachuted into wartime Britain as a German agent.

Similarly Maths Level 1, for children aged 4-6 contains a series of brightly coloured, animated games with musical accompaniment, teaching you to count, sort, add and so on.

The Cheshire Cat series — not intended to fade away.

TV freeze-frame by Tellyprinter

Telly addicts will soon be able to get a 'still' of their favourite scene from any TV programme and have it reproduced on paper, provided they have a TV with a video output socket and a special thermal printer for around £100 from Mitsubishi Electronics.

The system also lets you freeze and save Prestel and teletext pages, but printout is in black and white only.

Marketing assistant Steven Wankling said he expected the printer to be available from October onwards, adding that the company would initially sell direct. It will consider selling the unit via the Mitsubishi TV dealership too, depending on demand.

'We are bringing in a small quantity — several hundred — at first,' he said.

The system works by taking an image off the TV screen via the video socket and landing it in the printer's digital frame store. It then starts printing out the image on paper, 'like a screen dump program,' according to Mr Wankling.

Enquiries should go to Mitsubishi Electric Corporation in Rickmansworth, Herts on (0923) 770000.

Soft on Sharp

To coincide with the appearence of Sharp's MZ700 series (Pro-Tested in this week's *PCN*) Solo Software has released software covering games, utilities, and modest business applications for the machine.

Sharp launches have regularly been dogged by the lack of good software and Solo aims to prevent this happening to the MZ700.

Its catalogue includes five adventure games, many of which sound like a home game at Chelsea, 25 'pocket-money' games, 13 old favourites like Frogger and Fighter Command, six business programs, and educational systems

The business programs are a simple database, sales and purchase daybook, sales and purchase analysis, and various routines devised for club organisers. Prices range from £6.95 to £78.

The adventures and old favourites are all £6.95, the pocket-money games £3.95, and the educational material will set you back between £3.95 and £6.95.

Sharp itself is offering software for the system, but has stressed that the MZ700, with its tape-loaded languages, is largely intended to appeal to the programmers among you.

PROMOTES ACTIVE LIFE — Pete and Pam has the lastest US users' guide to the IBM PC in a software product called PC Pal. Games, animation and sound are all used in its introductions to the keyboard, the software and the hardware. Apart from a PC you'll need 64K, one double-sided disk drive, and an 80-column display. The sofware itself comes on a double-sided disk and, with the manual, will cost you £27 from Pete and Pam on (01) 769 1022.

CP/M chip frees disks

One of the drawbacks of a disk-based operating system is that it occupies one of your disk drives for a certain amount of time. Users of the Midas micro can now get round this problem by installing CP/M on a ROM chip.

The ROM-based CP/M comes from Sirton Computer Systems and uses an S100 EPROM board which holds an image of CP/M 2. This occupies about 8K and it is copied into RAM when the host machine is booted. The method is faster as the computer does not have to translate from disk, it reads its memory.

'For some applications, such as logging data in a laboratory, having two disk drives is like using a sledge hammer to crack a nut, totally unnecessary,' said Lionel Moon, managing director of Sirton.

But with only one drive there are disadvantages: it is not possible to copy disks; the system programs can take up most of the disk leaving no room for data; there is a lack of security against data loss.

A standard version of the product costs £150 and custom modification is also available. Information from Sirton on 01-640 6931.

Take the cure

Matching hardware and software can be a daunting prospect; a new service in Leeds aims to simplify it. Since it's been named the Software Surgery it might be just what the doctor ordered for bemused micro users.

The Leeds Computer Centre in conjunction with Great Northern Computer Services (a software manufacturer) is offering free advice in the form of a surgery. Designed to aid the businessman with his ailments, it claims to give unbiased advice 'from the best people in the business'.

The surgeries will be held every Thursday at the Leeds Computer Centre's new showrooms in Wade Lane, Leeds. All you have to do is to make an appointment by calling in person or telephoning the centre on (0532) 458877.

On display are a wide selection of micros from personal computers such as Nascom, Sharp, Gemini and Epson to the advanced Quantum 2000 business systems. Various software packages will be demonstrated and specific queries answered on the spot.

The surgery is still in the experimental stages. Should several queries of a similar nature crop up the centre may set up specific days to cover certain business activities.

Multi-micro accounting

An accounting system called SunAccount has risen for users of most micros, current exceptions being Sord and Commodore.

SunAccount comes from Systems Union. It is a combined ledger system with automatic posting to sales, purchase and nominal ledgers. It handles multiple ledgers permitting you to run different companies' accounts on one system and, if necessary in different currencies. You can name ten different analysis categories, each possessing an unlimited number of analysis codes. A menu is provided to aid the non-expert and help routines are a permanent feature.

Systems Union can be contacted on 01-485 2594.

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PCN 8/9

Getting it taped

ACE MANOEUVRABILITY — Pro Ace is a joystick designed to be used with the Commodore Vic 20, 64, Atari and other machines. Selling at £12.95 it is a sturdy little number with a steel shaft insert encased in moulded plastic. There is a fire button on the stick and a 'dual action' fire button on the front of the base. It also has a non-slip rubber base pad supposed to give you the arcade feel. The Pro Ace will be available in October through computer retailers or direct from its manufacturers, Sumlock Microware, 198 Deansgate, Manchester M3 3NE on 061-834 4233. The hand holding it is not an essential accessory and its position demonstrates a basic misunderstanding of the purpose and function of a joystick. How will he hit the fire button from there?

A 4Mb tape cartridge system designed and built in the UK has been produced by Data Track Technology for commercial and business users.

The Tracker 1600 is primarily intended for data logging but according to Data Track you can also use it to back up disk storage units — it will take you about half an hour to back up 4Mb down a serial line from your micro.

It incorporates a standard DC 300 XL cartridge but has some intelligence of its own. It features a 6K data buffer and intelligent search for individual characters or character strings. The unit also has switchable block sizes, automatic re-start if the power fails, automatic polling and others.

It will handle all the data formatting, buffering and handshaking needed to transmit or receive data through either of two RS232 interfaces operating at speeds of 110 to 19,200 baud.

Data Track Technology has been a distributor of US peripherals but the launch of the Tracker 1600 marks its debut as a manufacturer in its own right.

Its next release is likely to be a 5¼in floppy drive, which will be followed by a Winchester streamer in about a month. Beyond that it plans a 3½in floppy, and in the new year the capacity of its cartridge storage units is expected to be lifted to 10Mb.

The company is in New Milton, Hampshire, on (0425) 619650.

Big three back attempt to set comms standard

Three of the biggest names in the US micro business have put their weight behind a move to standardise communications protocols between personal computers.

Apple, Visicorp, and GTE Telenet have given their support to a protocol devised by Microcom. This data communications specialist is aiming to impose its network protocol on the Babel of comms dialects that make it difficult (if not impossible) to establish any operational contact between micros of different makes.

Microcom says that its protocol lets personal computers talk not only to other small systems but to minis, mainframes and public data networks. It will license its protocol to micro makers who want to incorporate it in their products for a one-off charge of $2,500.

Miracle drugs like this often have inconvenient side-effects and you should wait for concrete evidence before you get excited about the possibility of linking your system to anybody else's. They also take time to develop.

Trans globe computing

Attention Commodore users! A user group from the land of perpetual sunshine on Queensland's Gold Coast in Australia is trying to establish contacts with UK user organisations.

The Southport Commodore Computer Users Group appears to be concentrating at the moment on the 64, and it is looking for guidance in the matter of software.

If you can help, contact Bill Fitzpatrick at 5/19 Huth Street, Labrador, Queensland 4215, Australia.

PERSONAL COMPUTER NEWS

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PCN Charts

You've followed the micro charts — now here's the games top 30 compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets in the two weeks up to September 1 and, like the micro charts, do not take account of mail order sales.

The micro charts this week show the number of machines sold in the two-week period ending one week before publication date, so they tell the story in the high street between

GAMES

Top Thirty

			GAME TITLE	PUBLISHER	MACHINE	PRICE
▲	1	(4)	Manic Miner	Bug Byte	Spectrum	£6.00
▼	2	(1)	Jet-Pack	Ultimate	Spectrum	£5.50
▲	3	(5)	Flight	Psion	Spectrum	£5.95
▲	4	(8)	Horace and the Spiders	Psion	Spectrum	£5.95
▲	5	(7)	Ah Diddums	Imagine	Spectrum	£5.50
▲	6	(21)	3D Tanx	DKTronics	Spectrum	£5.50
▲	7	(13)	Arcadia	Imagine	Spectrum	£5.50
▼	8	(3)	Tranz AM	Ultimate	Spectrum	£5.50
▲	9	(10)	Penetrator	Melbourne	Spectrum	£6.95
▲	10	(15)	The King	Microdeal	Dragon	£8.00
▲	11	(25)	Gridrunner	Llamasoft	Vic 20	£8.50
▼	12	(11)	Jumpin Jack	Imagine	Spectrum	£5.50
▲	13	(14)	Mad Martha	Mikrogen	Spectrum	£6.00
▲	14	(—)	Kong	Ocean	Spectrum	£5.50
▼	15	(6)	Terror Daktils	Melbourne	Spectrum	£5.95
▼	16	(12)	Krazy Kong	Interceptor	Vic 20	£6.00
▲	17	(20)	Heathrow ATC	Hewson	Spectrum	£5.50
▼	18	(2)	Transylvanian Tower	Shepherd	Spectrum	£6.50
▲	19	(—)	Football Manager	Addictive	Spectrum	£5.95
▲	20	(26)	Timegate	Quicksilva	Spectrum	£6.95
▼	21	(9)	Killer Gorilla	MicroPower	BBC	£7.99
▲	22	(29)	Test Match	Computer Rentals	Spectrum	£5.50
▼	23	(16)	Monsters in Hell	Softek	Spectrum	£6.95
▲	24	(—)	Starfire	Virgin	Spectrum	£7.95
▼	25	(18)	The Hobbit	Melbourne	Spectrum	£14.95
▲	26	(—)	Harrier Attack	Martech	Oric	£5.95
▲	27	(—)	Battle of Britain	Microsimulations	Spectrum	£5.50
▲	28	(—)	Matrix	Llamasoft	Vic 20	£8.50
▲	29	(—)	Zoom	Imagine	Spectrum	£5.50
▲	30	(—)	Nightflight	Hewson	Spectrum	£5.50

PCN Charts

August 19 and September 1.

Neither mail order nor deposit-only orders are included and the prices quoted are for the no-frills models and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, will be updated every alternate week.

PCN Charts are compiled by MRIB (Computers), London, (01) 408 0250.

HARDWARE

Top Twenty up to £1,000

		MODEL	PRICE	DISTRIBUTOR
►	1 (1)	Spectrum	£99	(SI)
▲	2 (3)	BBC B	£399	(AC)
▼	3 (2)	Dragon 32	£175	(DR)
►	4 (4)	Vic 20	£150	(CO)
►	5 (5)	ZX81	£40	(SI)
▲	6 (7)	Oric 1	£99	(OR)
▲	7 (8)	CBM 64	£299	(CO)
▼	8 (6)	Atari 800	£300	(AT)
▲	9 (12)	TI99/4a	£150	(TI)
▲	10 (15)	Colour Genie	£168	(LO)
▲	11 (16)	Tandy Colour	£240	(TA)
▼	12 (11)	Atari 400	£150	(AT)
▼	13 (9)	Newbrain A	£228	(GR)
►	14 (14)	Sharp MZ80A	£549	(SH)
▼	15 (13)	Apple IIe	£969	(AP)
▼	16 (10)	Lynx 48	£225	(CA)
▲	17 (18)	Epson HX20	£472	(EP)
▲	18 (20)	Aquarius	£99	(MA)
▼	19 (17)	Sharp PC1500	£169	(SH)
▲	20 (—)	Microprofessor	£270	(SR)

Top Ten over £1,000

▲	1 (2)	Sirius 1	£2,525	(ACT)
▼	2 (1)	IBM PC	£2,392	(IBM)
▲	3 (4)	Apple III	£2,780	(AP)
▼	4 (3)	DEC Rainbow	£2,714	(DEC)
▲	5 (7)	Commodore 8096	£1,374	(CO)
▲	6 (10)	Televideo TS802	£1,960	(MI)
▼	7 (5)	Epson QX10	£1,995	(EP)
▲	8 (9)	Xerox 820	£2,415	(RX)
▲	9 (—)	Portico Miracle	£1,795	(PO)
▲	10 (—)	Osborne 1	£1,719	(OS)

AC Acorn Computers. **ACT** — ACT. **AP** — Apple Computer. **AT** — Atari International. **CA** — Camputers. **CGL** — Computer Games Ltd. **CO** — Commodore. **DEC** — Digital. **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **IBM** — IBM. **JU** — Jupiter Cantab. **LO** — Lowe Electronics. **MA** — Mattel. **MI** — Midlectron. **OR** — Oric. **OS** — Osborne Computers. **PO** — Portico Technology. **RX** — Rank Xerox. **SH** — Sharp. **SI** — Sinclair. **SB** — Sirtel. **TA** — Tandy. **TI** — Texas Instruments.

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The Vic 20 as a learning tool

May I offer a further answer to David Schilder (*Is the Vic right for learning?, Routine Inquiries, issue 23*) based upon my own experience of the Vic and its accessories, while teaching boys in the 8-13 age range. This experience includes the elements of computer programming and mathematics to Common Entrance, for which I use my own programs in class.

Everyone teaching or learning computer science on the Vic 20 must remember that it is a 'non-standard' machine, in the sense that government strongly encourages schools to purchase either Sinclair or BBC models. Within this limitation (and others imposed by the computer itself) I have found the Vic 20 very good indeed as a beginner's computer and far superior for this particular purpose to the three currently emphasised in school use.

A primary advantage for young people is the ease with which colour graphics can be produced and animated by PRINT statements entered directly from the keyboard. This is a strong encouragement to continue effort when, inevitably, one runs into difficulties.

Of even greater importance for teaching and learning purposes is the limited memory of the unexpanded Vic, even though the boys I teach are constantly asking for expanded systems. A strict limitation on memory strongly encourages the beginner to develop ingenuity, logic and precise programming technique in order to use fully the memory available.

I hope David will explore fully the potentialities of his Vic, without bothering about the claims made by users of other machines, until he is ready to turn to a more complex machine altogether. Incidentally, I would not encourage the great use of PEEK and POKE if a Basic word will do. Basic can be read as English and its logic followed, but tracing an error through a thicket of PEEKs and POKEs is often extraordinarily difficult.

David C Arnold
Ashburton, Devon

New light on Sphinx mystery

With reference to Jeremy Slater's letter (*PCN, issue 17*): he seems to have a very odd

Don't carry a LOAD on your shoulders, unburden yourself on *PCN*'s letters page.

solution to the problem of the extinguishing lamp in Acornsoft's Sphinx adventure. A far simpler way to get round this problem is to use the well-tried Aladdin Method whereby a simple *rub* of the *lamp* leaves it glowing brightly. Simple, don't you think?

Ashley Wainwright
Sheffield, S Yorks

What ENTER means to the Dragon

May I please point out a few corrections needed on the subject of Basic editors. In *PCN* issue 17, Julian Skidmore writes in Random Access that the Dragon's editor does the same if you press 'X' as if you pressed 'RETURN'. But he should know that the Dragon doesn't even have a RETURN key, but an 'ENTER' key, and what he said was wrong! Pressing 'X' takes the cursor to the end of the line, ready to insert something at the end, while pressing 'ENTER' ends the editing session, *ie* leaves the editor.

F R Ellahi
Halifax, W Yorks

When hacking becomes a headache

Using my Vic 20 for my business — mainly homebrewed software for heat transfer work, combustion equations, maths and games for my grandson — I spend many enjoyable hours in front of a black and white screen.

My concern if for the headache I get after two or three hours. I've checked my glasses, haven't changed my drinking habits, not in debt — yet — nor rowed with the wife lately.

Could it be that it's all too much for my 60 years? I understand electronic whizz-kids peak out at 30, or is it the old, addled, coddled or not quite as responsive brain cells being irradiated from that fiendish Taiwanian screen? Any ideas please.

Perhaps my wife is right after all. I am a nutcase.

Charles Hardy
Fordingbridge, Hants

Software bond: the customer pays

As as partner in a business supplying Sharp software by mail order, I am dismayed by the suggestion being put about by the Computer Trades Association that magazines should refuse ads unless supported by an insurance bond for prompt delivery or refund (*PCN Monitor, issue 22*).

Although the objective of eliminating the 'cowboy' trader is worthy, such a scheme would not be effective because of the time-lapse before bond-renewal became impossible. What it would achieve is an increase in the cost of software, because it is the customer who would ultimately have to pay the premium.

Surely the better solution would be for publishers (or the Computer Trades Association) to maintain a list of businesses about which repeated delivery complaints were made, and for this to form the basis of ad acceptance scrutiny. I am dismayed by the CTA suggestion of 56 days for delivery — we dispatch the same day!

D E Loverseed
David Computer Software
Bramhall, Stockport

How green makes me see red!

As I am sure that many eminent software authors read this magazine, I though I might make a special plea to them. Please keep off the green.

No, I'm not asking writers of adventure games to ensure that their demons, dragons, maidens or monster don't tramp all over the grass; and I'm not suggesting that authors of flight simulation programs shouldn't make their flights and manoeuvres around the sky too realistic. I'm just asking that software writers don't use the

PCN £10 Star Letter

colour green anymore.

People like myself who use the green monochromatic monitors can't see it. Green characters don't show up on a green screen!

Have you ever tried to play Monsters without the ladders? And what about chess: no matter how good you are at it, it's difficult to play it well when you see only half the board, particularly when the pieces keep appearing and disappearing as you move. And I assure you there's nothing more annoying than to get jumped on in an adventure game simply because you didn't read the warning sign — it couldn't be seen, it was in written in green!

So, perhaps we could institute a new programming rule to accommodate those of us who own monochramatic monitors: 'green is out'. Maybe your software reviewers can mention, in future, the amount of green factor that a program has. Then we would end up with ratings of appeal, playability, usability and greenness — that would be very useful.

D J Oborne
University College of Swansea

From today the big names in terminals have changed their inter-face.

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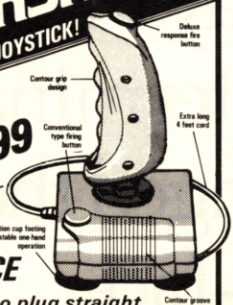

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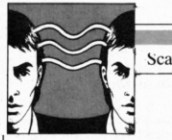


If you've got something to crow about . . . a bit of magic that'll make the world a better place for micro users, then send it to *PCN* Microwaves—our regular readers' hints and tips page. We'll pay you £5 if we print it. We'll pay you even more if your little gem gets our vote as microwave of the month. Think on . . . and write to Microwaves, *PCN*, 62 Oxford Street, London W1A 2HG.

Health-giving Epson sorts

HX20 owners may have found the FILES command useful for identifying files on cassettes, but have been frustrated by not knowing the date a file was saved. Such a feature would be advantageous when more than one version of a program has been saved. Program 1 accesses this information, automatically saved in the header of each file stored on a cassette. This program will work for files stored on either of the devices 'CAS0:' or 'CAS1:'.

```
100 CLS:PRINT "Enter dev
ice no? ";PRINT "CAS(0)
 CAS(1)?  ";CHR$(30);:D$
=INPUT$(1):' ENTER 0 OR
1
110 IF D$<>"0" AND D$<>"
1" THEN 100 ELSE D$="CAS
"+D$+":"
120 IF D$="CAS0:" THEN H
%=&H032C ELSE H%=&H02D8:
' H% POINTS TO START OF
HEADER
130 CLS:LOCATE 2,1:PRINT
 "Searching "+D$
140 ON ERROR GOTO 240:'
HANDLES ERROR FOR BASIC
PROGRAM FILES
150 OPEN "I",£1,D$+"*.*"
:' GETS FILE HEADER
160 F$="":FOR I%=0 TO 7:
F$=F$+CHR$(PEEK(H%+I%)):
NEXT I%:' GET FILENAME
170 E$="":FOR I%=8 TO 10
:E$=E$+CHR$(PEEK(H%+I%))
:NEXT I%:' GET EXTENSION
180 DA$="":FOR I%=28 TO
33:DA$=DA$+CHR$(PEEK(H%+
I%)):NEXT I%:' GET DATE
190 TI$="":FOR I%=34 TO
39:TI$=TI$+CHR$(PEEK(H%+
I%)):NEXT I%:' GET TIME
200 CLS:PRINT "File: ";F
$:' ";E$
210 PRINT "Date: ";LEFT$
(DA$,2);"/";MID$(DA$,3,2
);"/";RIGHT$(DA$,2)
220 PRINT "Time: ";LEFT$
(TI$,2);":";MID$(TI$,3,2
);":";RIGHT$(TI$,2)
230 CLOSE:GOTO 150
240 RESUME 160:' IGNORES
 ERROR
```

Program 1

The program reads in a file header by opening a file for input. As Basic program files cannot be OPENed, error trapping in line 140 is needed. H% points to the area in memory used by the HX20 to store the header, accessed by PEEK statements. The area used varies depending on the device being used.

Elizabeth Wald,
London NW3

Colour Genie mapped

Table 1 shows the way the Colour Genie's keyboard is mapped into memory. Using this, you can read the keyboard directly and so avoid problems caused by INKEY$.

For example, to read the X key, you could use IF PEEK (&HF808) AND 1 THEN . . . instead of IF INKEY$="X" THEN . . . This is based on PEKK (*address of key group*) AND *bit value for that key*.

This works for any key on the keyboard except Break. However, you can read Break if you first disable it with POKE 16396,23. POKE 16396,201 to re-enable it.

John Constable,
Broadstairs, Kent

The 64 waits on you

A 'press any key to continue' style pause on a Commodore 64 can be a bit fiddly because you ought to make sure that the keyboard buffer is empty before using a GET test.

One simple alternative is WAIT 197,191. This looks at the keyboard location (197) and waits until a key is pressed — that is, its value changes from 64.

David Gristwood,
Sunderland, Tyne and Wear

Atari down in dumps

This short two liner lists a cassette file to the screen on an Atari. Beside being useful for dumping cassette data files onto the screen or looking at unindexed tapes, it can be used to verify programs that have been saved using LIST "C:".

The routine dumps to the screen and so won't affect any program in memory. If all goes well, you'll get an EOF error at the end of the file.

```
10000 CLOSE #1: OPEN
#1,4,0,"C:"
10010 GET #1,C: PRINT
  CHR$(C);:GOTO 10010
```

F M O'Dwyer,
Dublin, Ireland

Colour Genie Keyboard Map

Bit	7	6	5	4	3	2	1	0
Value	128	64	32	16	8	4	2	1
Address								
&HF801	G	F	E	D	C	B	A	@
&HF802	O	N	M	L	K	J	I	H
&HF804	W	V	U	T	S	R	Q	P
&HF808	F4	F3	F2	F1		Z	Y	X
&HF810	7	6	5	4	3	2	1	0
&HF820	/		-	,	;	:	9	8
&HF840	SPACE					BREAK	CLEAR	
&HF880				CONTROL	REPEAT		MODE SELECT	SHIFT

Table 1 Colour Genie keyboard map

Positive aspect to negatives

A ZX81 or Spectrum will produce an error if you attempt to raise a negative number to a power. To avoid this, use a short routine like this:

```
10 REM A=B**P ZX81
20 LET S=1
30 IF B<0 AND P=INT(P/
2)*2
   THEN LET S=-1
40 LET A=S*ABS B**P
```

Obviously, on a Spectrum ↑ is used instead of ** and lines 20 and 30 can be written as one line.

Ken Chua,
Birmingham

Vic clock goes faster

The TI clock on the Vic 20 can be set to update at intervals other than its usual 60 times a second. To do this, use a routine like this:

```
N=1109404.5/R
HI=INT(N/256)
LO=INT(N-HI*256)
POKE 37156,LO
POKE 37157,HI
```

R is the number of updates per second. The slowest speed is about 17 times a second. Theoretically, the fastest speed is about 1.1 million times a second, but the more time the Vic spends dealing with the clock, the less time it has for everything else. Set the speed to 10000 and see how slowly it LISTs!

This trick could be useful to speed up programs — just set the clock at 17Hz. One unfortunate side effect is that auto repeat and cursor flashing are affected. Both use the TI clock for timing.

David Walker,
Ellesmere Port, Wirral

Light on Lynx listings

Long Lynx listings can get awkward because it is difficult to tell where particular subroutines and procedures start and finish. One solution is to add a little colour to the program.

At the start of a new section, include a REM such as REM**. Then DPOKE LCTN(*line number*),1+256**ink colour* or DPOKE LCTN(*line number*),2+256**paper colour*. When you LIST the program, the colours will change as you have set them.

To change both INK and PAPER colours at a single REM, make the REM four characters long and use a second poke such as DPOKE LCTN(*line number*)+2,2+256**paper colour*.

Peter Bach,
Randers, Denmark

Putting a stop to Orics

To stop a program from auto-running on an Oric 1, you could try the following commands:

```
POKE 49120,72
POKE 49121,169
POKE 49122,00
POKE 49123,133
POKE 49124,99
POKE 49125,104
POKE 49126,76
POKE 49127,03
POKE 49128,236
DOKE 553,49120
```

Now load the program in the usual way. The routine redirects the keyboard interrupt program.

David Barr,
Preston, Lancs.

ROUTINE INQUIRIES

Lost in a maze of bits and bytes, trapped in a forest of errors, or bugged by Basic? Whatever your problem, access our HELP function . . . better known as Max Phillips.

Write to: Max Phillips, Routine Inquiries, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

The write approach

Q I am a writer and have been long aware that more and more of my colleagues are using Apples and Tandys for their trade. At £4-£5,000 I couldn't afford such a system, but two offers have caught my interest.

One is a BBC Model B with Wordwise and all the bits and pieces for £1,200. The other is an Osborne with Wordstar for £1,150. My inclination is to use a BBC system with something like a Brother or Juki printer, but I'm worried that a single disk drive and Wordwise won't be able to cope. Alternatively, would I be wasting money buying features I didn't need with Wordstar?

John Hines,
Usk, Gwent

A My personal reaction in any such situation is to go for the serious business system. You're a professional, you'll need professional tools — both in terms of features, ease of use and reliability. For the most part, that makes Wordstar a good idea.

There are alternatives — Apples, Microdecisions and so on. Cromemco markets a luxurious little system called the C10 which runs its own Writemaster. The point is that it will be worth the extra to get a system you are comfortable using. The Osborne itself can be a strain for long periods of time, and you would have to get an 80 column system with an additional full size screen and probably double density disk drives.

Single disks are workable. But they ae not a good idea if the hassle of disk copying puts you off making regular back copies of your work. In short, get two drives.

I'd also be wary of the printers you mention. They are very slow. But you may not have to buy a £2,000 wonder-printer to get both speed and quality. Many top dot-matrix units can manage reasonable quality at a good rate. What's more, they are usually switchable, so you can churn out drafts at incredible speeds.

Apple files identified

Q When a disk is catalogued on the Apple II, letters are printed on the left hand side which show the type of file. What are R and S type files, and how do you run them? Also, how do you save an Apple shape table to disk?

Luke Richdale,
3 Onslow Gardens, London

A The R-type file is generally an object file generated by an assembler or compiler, which is held in a special format so that it can be 'relocated'. This means that it can be run at any vacant place in memory.

This type of file cannot be run directly, but must be prepared by using the RBOOT and RLOAD programs on the master disk, or alternatively by a link-editor. This would reformat the file upon loading so that it will run at the desired address. See the documentation on the Apple DOS toolkit.

The S-type file, on the other hand, is something of an unknown quantity . . . it's never been used by Apple, nor is there any published information on the format. However, it is reputed to be useable for saving graphic images in some kind of compressed format.

In fact, there's more there than many imagine, because there are in fact *two* types of A and B files. The normal ones we know all about, but the other two are totally undocumented, have never been used, and in view of the imminent release of ProDOS, the new SOS-compatible Operating System for the Apple, probably never will be.

As for saving shape tables on disk, you just do an ordinary BSAVE, giving the address and length as usual. It's up to you to decide where you want to put them.

Vic back slash a throw-back

Q Many Vic listings contain a graphics sysmbol which I can't recognise. it is a reversed back slash. It's not in the manual and no amount of fiddling will produce it.

Where is it on the Vic keyboard and what does it do when you use it?

L Jones,
London SW9

A This little curio is a Control Red. When you actually try it, you'll get a reversed pound sign. The reason is simply that many listings are produced using PET printers rather than the dedicated Vic printers. These print the reversed back slash where a Vic would display and print a reverse pound sign.

The confusion should go away as more 1525s are used.

A peek at RANDOMIZE

Q Could you please explain the RANDOMIZE USR command on the Spectrum. I understand that it is something to do with calling machine code. but I don't know how to use it. I've tried various numbers. RANDOMIZE USR 1331 produces a high pitch sound, 3114 produces a screen full of question marks, and so on. What does it do?

D Denson,
Bebington, Wirral

A You understand more than you think. RANDOMIZE USR *address* does call a machine code routine. Just that! Most micros use a command CALL or SYS for the same job.

So why this rather strange command? It's actually the USR that does the calling. USR is a function — it calls the relevant machine code and then returns a value from the machine code to Basic. So you might write a USR routine that returned the amount of free space left. You could use it like PRINT USR 32500 or whatever.

Some of the time, you don't want to return a value from the machine code for example, a routine to reverse the screen doesn't have a 'result'. You still use USR to call the program but you want to ignore the number it brings back. The standard dodge is just to use the space saving and harmless RANDOMIZE USR construction. Whatever the machine code says is 'the result' is used to seed the random number generator.

Now what about your magic numbers? As you know, the number that follows the USR is the address of the machine code to be called. This could have come from two sources — the Sinclair's ROM is full of useful routines that you may be able to call if you know where. And you might POKE your own machine code into RAM and use USR to call it.

One POKE over the line

Q I have a Commodore 64 and have a problem with it. Whenever I use POKE in a loop the computer gets so far and then comes up with a syntax error.

If I then LIST the program, there's often a filing command (usually CLOSE) inserted randomly in the program. This program is an example:

```
10 PRINT "CLR/HOME"
20 FOR C = 0 TO 20
30 I = INT (2023*RND
(1))+1024
40 POKE 1,160
50 POKE I+54272,0
60 NEXT C
```

Neil Summer,
St Austell, Cornwell

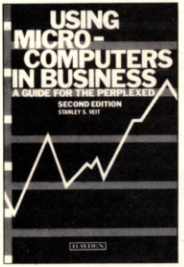
A I'm not too good with mysteries but I know a bug when I see one. There's nothing wrong with the 64 - you've just made some mistakes.

First, you use I to pick a random screen location. The screen runs from locations 1024 to 2048. But line 30 generates numbers from 1024 to 3047. Remember that a RND function like the one you've used should be X = INT(RND (1)**number of numbers to pick from +lowest possible number.*

What results do you get? It will work some of the time but sooner or later you'll start POKEing beyond 2048. This is the RAM used to store your Basic program. Suddenly, it is raining code 160s onto your source program. Guess what a 160 means if the interpreter finds it inside a Basic program? It's the token (or code) for the CLOSE command.

As for POKE 54272 onwards to set the colour codes, you'll find that colour memory runs from 55296 to 56295. Again, you're simply POKEing in the wrong place.

Which book would your micro want you to buy? *PCN*'s review page helps you choose.



'Using Micro-computers in Business' by Stanley S Veit, published by Hayden at £11.50 and distributed by John Wiley & Sons (paperback, 180 pages).

A computer writer who knows the ins, outs and roundabouts of business invites business managers considering computerisation to reciprocate in learning about micros and micro systems.

This overview of business application software, electronic spreadsheets, networks and the like certainly envisages the managers in the thick of things. There are instructions on how to brief the programmer and on drawing up database system specifications, for which there's an appendix.

It's assumed that armed with the right information, the go-ahead entrepreneur will have the ability to assess what the firm/department wants from micros.

As is usual with micro guides for the ignorant (euphemistically called 'the perplexed'), it is most useful when getting down to the nitty-gritty. The reader is introduced to specific word processors and packages with advice on what's popular and what isn't and why. Or you're kindly told not just what makes a good database, but why finding the right one might matter. The questions of whether to stick with big-name manufacturers and what to do about upgrading the equipment are considered, and there's advice on avoiding the mistakes of making false economies.

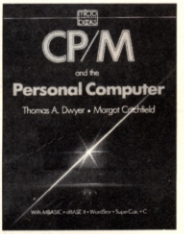
Also made clear in a no-nonsense sort of way is that you can't get away with just reading this book.

The care needed in getting a reputable consultant is stressed from the start. **HA**

'CP/M and the Personal Computer' by Thomas A Dwyer and Margot Critchfield, published by Addison-Wesley at $19.95 (paperback, 492 pages).

How did it all begin? Nobody knows. The start of the story is lost in the mists of antiquity, and the sands of time have drifted over the opening chapter. One minute there was talk of how micros would bring user-friendliness to mankind, and the next minute there was CP/M.

Saddled with CP/M, we've been trying to make the best of it ever since. This book tacitly recognises this noble struggle fairly early on: 'When you buy CP/M you usually receive



copies of the official CP/M manuals . . . It's safe to say that beginners have found these manuals confusing. Several less charitable adjectives have also been used.'

So: in order to give CP/M the benefit of the doubt, you need to approach it through a third party, in this case Dwyer and Critchfield. And let's admit straight away, you could do a lot worse.

This is perhaps as lucid and useful a book on CP/M (and related products) as you could hope to find. It covers a remarkable amount of ground at an even pace with a sprinkling of whimsical illustrations (plus colour) and text that is made to look interesting and that reads well.

It isn't cheap, but if you sat down and worked your way through almost 500 pages you'd probably cover something equivalent to a degree course. And it won't just be CP/M you'll have graduated in, but also a wide variety of programming concepts and a fair range of program products. Among the latter is Unix, which may be the subject of the next such book you'll need to look at if the irresistible march of fashion proceeds unchecked. **DG**

'Getting Started with the Epson HX-20' by Stan Corlett and John Cain, published by Phoenix Publishing Associates at £5.95 (paperback, 118 pages).

This book is designed to complement the native HX-20 documentation rather than compete with it. It is really a beginner's guide to Basic with the HX-20 as the intermediary.

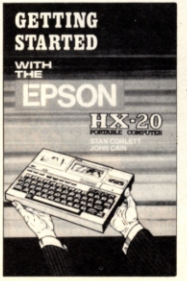
It purports to direct the reader/user towards programming for business, with special reference to its portable possibilities.

It is very basic — starting from the beginning and taking no previous knowledge for granted. All the concepts, including data files, arrays and so on are explained and demonstrated, the idea being that the reader will eventually be able to develop his own simple programs. For instance, the book demonstrates a vending machine program. This could represent a typical HX-20 application where portability is an essential element.

The style has the familiar user's guide feel and is concise and useful.

Although the concept of this book is laudable, effective programming, especially for a business where a program's reliability is essential, requires a bit more knowledge than that provided by this slim volume.

As the title says, this book is about 'getting started' with the Epson HX-20 — it's really just a primer for computer beginners, not a definitive text for programming for your own small business. **IS**



'Creating Adventure Programs on the BBC Micro' by Ian Watt, published by Interface Publications at £6.95 (paperback, 128 pages).

'Spectrum Adventures — a Guide to Playing and Writing Adventures' by Tony Bridge and Roy Carnell, published by Sunshine Books at £5.95 (paperback, 186 pages).

Writing adventure games is probably more fun than actually trying to solve them (more remunerative too). It's not difficult to see why this type of game has become so popular among computer hobbyists. If you've the type of brain that delights in solving problems then adventuring and programming are a rewarding combination.

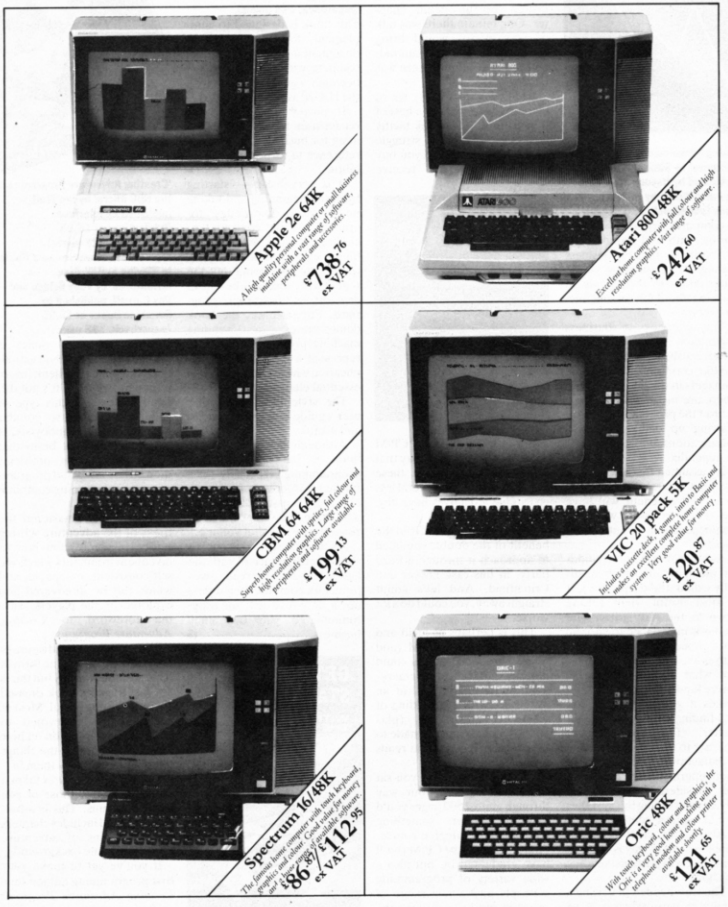
'Once you've mastered the tricks of the adventure writing trade . . . you'll know how to invent environments which are self-consistent, mappable, and which can be discovered and explored by the players,' says the foreword to *Creating Adventure Programs*.

Two complete adventures are provided here in the form of Dracular and Journey but this is not just a listing book dressed up as something useful. Most of the material is devoted to passing on information on how to write and design the things rather than just copy them in.

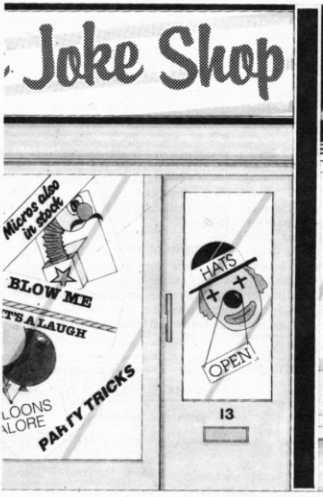
Spectrum Adventures takes a similar route for those of you with Spectrums. This is a bulkier tome and includes chapters on the origins of adventure games and some background.

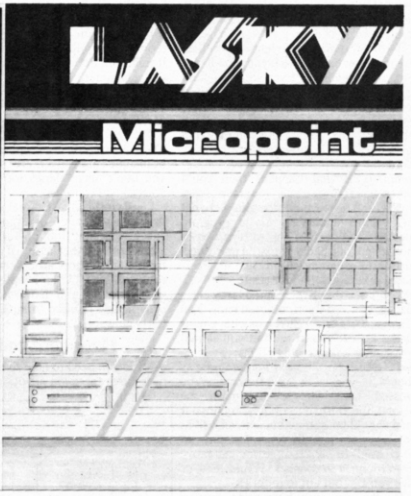
If you've yet to make your first programming million then *Creating Adventure Programs* or *Spectrum Adventures* could be a good capital investment. **IS**

If you think seriously about Micros.....



. . . think seriously who you buy from.





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Now for the crucial stage in devising your game: planning the map. Advice from John Noad as . . .

The plot thickens

In part one we covered the basic steps involved in writing a computer adventure program. You'll now need a rough, written description of your adventure, several sheets of paper marked out in squares or octagons, a pencil, an eraser and several felt-tip pens. The coloured pens are particularly important as we come to create a working map.

If you have good imagination you may already know exactly what you want to put into your adventure. Even so, it's a good idea to take time over the preparation of your map — the creation of the map is usually the central activity in writing an adventure. Go too fast and you may find that, when that sudden burst of creative ideas hits you, the map is already nearly complete. If that happens then you'll either have to re-draw the map (very frustrating) or leave out the gimmick that might have made the whole program special. Moreover, trying to turn two or more pages of a badly prepared map into a successful program will involve unnecessary work.

You'll see that I've updated last week's map using a variety of coloured lines. You can make your own choice of what colour to use for each function, but you should cover at least four main options:

Red — see room 14. All room boundaries should be marked in red if they *cannot* be crossed. Thus, with one exception (see below), the entire outer boundary of your map should be outlined in red, as well as any internal room-divisions that may not be crossed. In my example you can move from room 14 to rooms 7, 11 and 18 — or vice versa — but not to room 15.

By the way, see how using *internal* function lines in rooms 14 and 15 allows moves between rooms 11 and 18 without making the map too confusing.

Purple — see room 4. There may be times when you want to trap a player into following a certain route. On my map I've done this by placing a door between rooms 4 and 7. At the start of the game this door stands open, but if the player goes through it then it automatically closes. Since it has no handle and no keyhole on the far side it cannot be opened again from room 7.

To make this clear to myself I put a purple — 'one way' — line on the northeast side of room 4, and a red — 'no way' — line on the southwest side of room 7.

Orange — see rooms 1 and 19. As well as the normal eight directions allowed in an octagonal map you might want to include movement Up and Down (both within a single level or to connect up a multi-level game). Here I've created a tunnel under the obstacle occupying rooms 5, 8, 9 and 12. The tunnel connects rooms 1 and 19 and, in this example, may be entered from either end.

Alternatively, the tunnel itself could be a room, or the means of reaching a different level.

Blue — see room 10. At first sight rooms 6 and 10 might seem to offer the same situation as rooms 4 and 7. The difference lies in the blue line on the northwest edge of room 10.

In this case the door may be opened from room 10, but only in certain circumstances. It might be necessary to find a key, or a sledgehammer, somewhere else in the maze. Or it might open in response to a magic word written on a wall in one of the passages.

These are only the basic options that might be included in an adventure map. Provided you don't make things too complicated you can add your own.

Until you become familiar with the code that you decide to use, it's a good idea to set out a chart of the colours and their meanings at the side of each map. Incidentally, shop around when buying coloured pens. When I replaced my own set recently I found that even the cheaper pens ranged in price from 60p for five to thirty pens for 79p!

Movement codes

Why do you need to take so much trouble over the preparation of your map?

The answer is that, somewhere in your program, you will need to supply a table of 'movement codes', based on your maps. These codes are a central feature of any adventure because it doesn't help to know where you are if you don't know where you're going.

Look at room 1 and you'll see that there are three possible routes in and out of the room. But how would the computer know that? It can't see the map, so it must have a 'look up' table to tell it which moves are valid for each room.

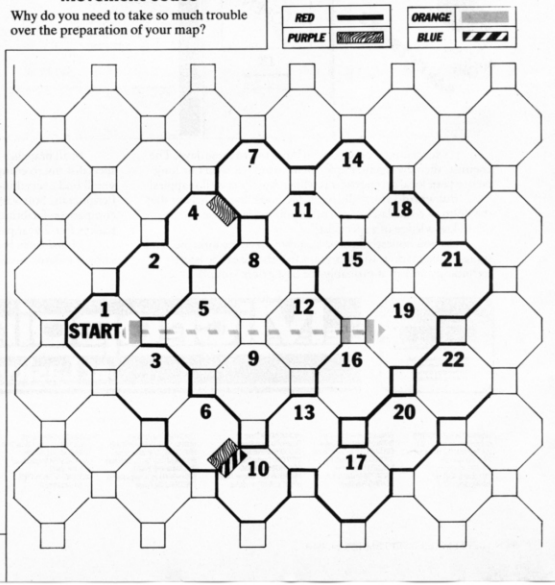
Now, since we're working with an octagonal map we need a table with either ten or eight moves for each room, depending on whether movements Up and Down are allowed.

Let's assume that we allow movement in all ten directions. In that case our table of movement codes for room 1 will look like this:—

N=0: NE=2: E=0: SE=3: S=0: SW=0: W=0: NW=0: U=0: D=19

The logic here is pretty obvious. The variable for each direction is given a value that represents the room you will enter if you move that way. Where there is no room to which you can move then the value

23



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DASM is a two-pass symbolic assembler which allows labels of any length (the first five characters are used). All the 6809 mnemonics and addressing modes are supported plus comprehensive assembler directives for defining constants, reserving memory, directing output to screen or printer. Errors detected by DASM are reported with easy to understand text messages.

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```
RUN
=====*** START OF TEXT ***
00010 REM
00020 REM >>> EDIT+ THE FULL SCREEN EDITOR <<<
00030 REM     ============================
00040 REM
00050 REM              from COMPUSENSE
00060 REM
00070 REM dump HI-RES screen to EPSON FX-80 printer
00080 REM
00090 REM run from EDIT+ to dump actual screen
00100 REM
00110 REM SET LINE SPACING TO 1/9TH INCH
00120 PRINT#-2,CHR$(27);"A";CHR$(8)
00130 FOR I=0 TO 31
00140 PRINT#-2,CHR$(27);"K";CHR$(192);CHR$(0);
00150 K=&H600+I*191*32
00160 FORJ=0 TO 191:PRINT#-2,CHR$(PEEK(K));:K=K-32:
NEXT J
00170 PRINT#-2:NEXT I
00180 REM RESET 1/6 INCH LINE SPACING
00190 PRINT#-2,CHR$(27);"A";CHR$(12)
00200 PRINT#-2:PRINT#-2:END
=====***  END OF TEXT  ***
```

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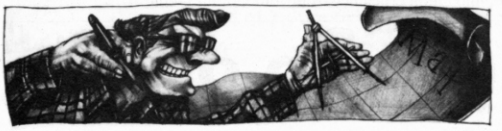


will be 0 (which is why room numbering must start at 1 and not 0).

This isn't the only method of calculating movement, but it does have the advantages of speed and simplicity. Its main handicap, shared by most other methods, is that it tends to eat up RAM space.

If you're able to use disk drives then the space problem does not exist, of course, since only one set of codes will be in RAM at any given moment. If you have to store the codes in an array, however, you will either need a two-dimensional array or a number of one dimensional arrays (in the Lynx, for example). Moreover, you can end up with the same information in two separate sections of RAM — in the program data statements and in the array made up from that data.

Actually, there is a way round this latter problem which involves POKEing the table into the space initially occupied by the data statements.

Assuming that a 'square' map — allowing movement in four directions only — takes up 100 blocks of RAM (regardless of the storage method), then a square map including Up and Down movement will require 150 blocks, an octagonal map will use up 200 blocks, and an octagonal map with Up and Down moves will need 250 blocks of RAM space.

The moral is clear. If you're working with a limited amount of RAM, say 16-20K, then your best bet is to stick to square maps. I'm afraid that this applies even if you are getting one of the new Sinclair microdrives since these allow sequential file reading only.

Character definition

One of the great unsettled questions discussed among computer adventures is: Should a player's (fantasy) characteristics be dictated by the player or by the computer?

In many games this problem doesn't arise since the player is given a character which doesn't change from one end of the game to the other. This has two drawbacks.

First, if the player is to be given a genuine sense of progress (other than simply moving around and achieving a set goal) then at least some of the problems within the game must be interlinked. For example, the answer to a riddle posed in room 39 might be a word which is spelt backwards. Later on this fact may become a clue to dealing with a section of the adventure which has been mapped in reverse — to go south you enter "GO NORTH", and so on.

An adventure which lacks this element of character progress can easily become nothing more than a set of unrelated puzzles. And unless those puzzles are particularly ingenious the overall result will be rather like a game of Space Invaders in which each wave of aliens starts at the same point and moves at the same speed as the wave before it.

The second drawback shows up only when you've completed the adventure. And in a 'static' game that's about it. Unless you happen to like action replays or have a really appalling memory there's no point in playing again. All you can do is go out and buy a new game.

Generally speaking, the characters in an adventure fall into one of three categories: the hero/heroine, other leading characters, and the minor characters.

So what's the alternative? Actually there are two, and I'll be discussing them in the concluding part next week. Meanwhile, there's another matter to be considered — the inhabitants of your adventure.

The hero. All the characters in an adventure should, of course, relate to the main story-line. It's possible to have a bare-chested, axe-wielding he-man in a space adventure, but an eight-foot, war-crazy alien with a lazer spear could be made to serve the same purpose, and would fit more realistically into the plot.

When you come to define the character to be used by the player, then, there are two main points to be considered. Try to make your hero/heroine a little out of the ordinary: think of the ways that fictional spies have been depicted over the last 80 years.

At the turn of the century spying was not the done thing, and in books at least British spies were usually innocent civilians who stumbled over military secrets by accident. The First World War changed people's views a bit and before long the gentleman spy appeared: tough but well-mannered characters like Bulldog Drummond in the '20s and '30s through to Dick Barton, Special Agent, in the '40s and early '50s.

Next came James Bond, still a gentleman (of sorts), but one who depended more on high technology than sheer strength. And lastly the mackintosh brigade, characters like Harry Palmer and George Smiley, ordinary people doing an unpleasant job in an unpleasant world.

Each of these character types may look a bit old-fashioned now, but each was a true original, and a best-seller when they first appeared.

Secondly, resist the temptation to make your central character a super-hero. The player should, ideally, have an exactly 50-50 chance of completing the adventure successfully. Stack the odds too heavily against the player and he will get frustrated. Stack them too heavily in the player's favour, on the other hand, and you remove the challenge and excitement from the game.

Getting this balance just right is seldom easy, but it's well worth the effort.

Other characters. Describing the occupants of categories 2 and 3 is more difficult, since their existence will depend upon the imagination of the individual writer.

Broadly speaking, leading characters will appear more than once during an adventure, and their relationship with the hero will play a major part in deciding the outcome of the game.

Where such a character is one of the 'good guys' he must be persuaded to assist the hero. If he is one of the 'bad guys' he must be defeated or outwitted. In the best adventures, leading characters are not identified in advance. It is up to the hero to sort the good from the bad and to act accordingly.

To illustrate the difference between these leading characters and minor members of the cast let's suppose that one of the characters is an old man.

If he is one of the minor characters then he will almost certainly exist at one location only. Should the hero meet this character then he may gain some piece of, possibly, useful information or be set a problem to solve.

Either way the outcome of the meeting need not be essential to ensure the hero's success.

However, if the old man is a leading character then he will probably appear at several different locations, or even accompany the hero on his journey. He may, for better or worse, be in disguise. And the information that he offers or the riddle that he sets should be of major importance. Indeed, if treated correctly, he may even provide extra information and/or the answer to his own riddle.

Thus minor characters tend to rate the same degree of importance as any other task, trap or problem facing the adventurer.

Leading characters, where they exist, should be as important as the hero himself. In this way they help to give the game a sense of continuity. The more real they appear the more satisfying the adventure will be for the player.

Next week Creating your characters and — the most difficult part — planning the 'interior decor' of your rooms.

Kieran Phelps

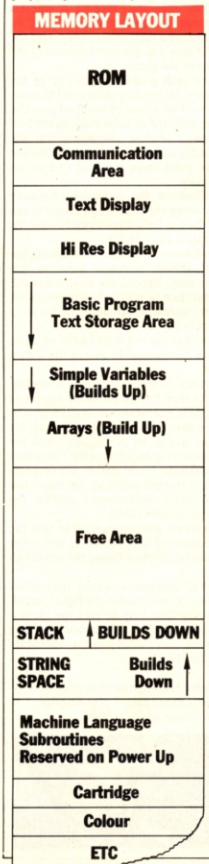
Ken Hook reveals the ways to get maximum efficiency from your Colour Genie.

Genie genes

Basic can never match the execution speeds of machine coded programs. On the other hand, writing and debugging machine language programs is not easy. Even the smallest of programs can take hours to debug. The slightest error can send your program on a journey to nowhere, and leave you staring at a blank screen. There are no error messages flashed up on the screen to help you find the error *eg* 'Syntax Error in 40'.

To efficiently de-bug a machine language program, you sometimes have to play computers with your code. Obviously, to do this, you need to have a good knowledge of how your computer works.

With most programs, a happy medium can be struck. The bulk of the program can be written in Basic, with machine code sub-routines handling the parts that need to be speeded up. For instance, if your program deals with a 'sort' routine, you can speed this section up by a factor of 1,000 in some cases. And this is only one example — graphics, animation, utilities can also be aided.



RAM structure

When you use the Basic statement CLEAR 100, the Colour Genie clears this amount of memory at the top of RAM, and immediately below this space the computer puts the Stack Area. The Stack Area builds down from high memory to low memory.

You can deduce from the Genie's memory layout (left) that, if you place a machine code program at the top of memory, and then your Basic program executes a CLEARnn when you run it, your machine code routine is no more. It will have been over-written by the String Area. This is the reason you save memory on power up. Once you have answered MEMORY SIZE?, your subroutine is safe from the house-keeping of Basic.

Studying how the Basic interpreter works and where it stores information will help you to write handy utilities. For example, you can channel all LPRINT instructions to the screen without having to change the LPRINT instruction to PRINT.

ASCII

Most computers use ASCII (American Standard Code for Information Interchange) when dealing with standard characters like '12' or 'yes'. ASCII is coded into 7 bits (0-6), which means that 128 separate codes can be defined from a byte. With normal characters (1,3,aB,+,etc), bit 7 is reset to 0. With graphic characters bit 7 is set to 1, which gives the computer a further 128 characters that can be defined from one byte.

In the Genie this is further expanded by the computer looking at address 431C Hex to see which character mode you have selected by CHAR n. The control codes (Cursor Up, etc) 0 through to 31 are non-printable characters, but can be used within a Basic program to move the cursor around the screen, for example, or to clear to end of line.

Basic

To really get to grips with ROM and RAM you need a disassembler which will allow you to look anywhere in them, and will print out the instructions at each address. Listing 1 allows you to PEEK anywhere in readable memory. It will display the memory location followed by whatever is

EXAMPLE OF TOKENS AND ROUTINE ADDRESSES COLOUR GENIE

TOKEN	COMMAND	ADDRESS	TOKEN	COMMAND	ADDRESS
80	End	1DAE	81	For	1CA1
82	—	—	84	Cls	0C19
86	Random	01D3	87	Next	22B6
88	Data	1F05	89	Input	219A

NEW TOKENS UNIQUE TO COLOUR GENIE . . . ALL PREFIXED WITH FF.

80	Colour	38C9	81	Fcolour	38D5
82	Keypad	3A63	83	Joy	3A0F
84	Plot	3BC1	85	FGR	38A9
86	Lgr	38B0	87	Fcls	3846
88	Play	3D57	89	Circle	3AF8
8A	Scale	3AF1	8B	Shape	3CDD
8C	Nshape	3CD8	8D	Xshape	3CD3
8E	Paint	3E46	8F	Cpoint	3677
90	Nplot	3B8D	91	Sound	3F95
92	Char	3FA8	93	Renum	3222
94	Fill	385D	95	Fkey	3466
96	Call	355A	97	Verify	3FFD
98	Bgrd	38B7	99	Nbgrd	38B8
9A	—				

EXAMPLE OF ASCII CODES

CODE	CHARACTER	CODE	CHARACTER
32	SPACE	33	!
34	"	38,	&
39	'	50	2
77	M	122	z

in that location. If the value in memory has an equivalent ASCII value it will print it. Otherwise it will print the actual value in that location. This program is *not* a disassembler, but will allow you to investigate a few interesting points of the Basic ROM and RAM.

Using the program, look at locations 14640 to 14763. It should look similar to this:

nnn : OLOUR :nnn: COLOUR:nnn: EYPAD . . . . . (where *nnn* is a number). These look like Colour Genie commands, and they are.

Reserved Word Lists

You have just been spying on one of the Colour Genies' Reserved Word Lists. Whenever you type in a Basic statement, *eg:*

1 CLS
2 PRINT "THIS IS A TEST."

it is scanned by the interpreter for reserved words. When a match is found, the word is replaced by a number, unique to that word, called a token. The statement is now 'tokenised' and is saved in the Program Statement Table (PST).

When the program is run, the computer hands control over to the Execution Driver, which scans each statement for tokens, and if one is found, passes control to the routine which deals with it. But how does the computer know where the subroutine is for a particular token? This is the part we are interested in because, if we know how the computer finds the subroutine, we can find it also, and then we can use this same subroutine in our own machine code programs.

In the Colour Genie there are two main Reserve Word Lists; one at 1650 Hex and another at 3930 Hex (the one you have just been looking at). When the computer spots a token *eg* INPUT, it knows immediately which routine to branch to. The value of the very first token is 80 (END), and all other tokens are increments on this number.

With INPUT = 89, for example, the computer just deducts 80 from the token and adds this to the first location, which gives the displacement 10 for the command INPUT. The computer now jumps to the Verb Action List, which follows on the heels of the Reserved Word List, and keeps going until it reaches the 10th address (an address is held in two bytes, so it is in fact the 20th position down the table). Here it finds the address of the routine that handles the INPUT command, and jumps to that address.

The token for CLS is 84, and the address of the subroutine is at OC19Hex. In a machine language program, knowing this information, instead of writing numerous lines of code to clear the screen, we just need the instruction CALL OC19 and like magic the screen is cleared.

Take a look at the table (left) which will interest both experienced programmers and beginners, as it gives the addresses of most of the new commands used in the Colour Genie. One further comment on the matter of tokens. The new tokens on the Colour Genie start at 80 but are prefixed with FFHex, *ie* the token for CIRCLE is FF89HEx.

Basic statements

Basic statements in the Colour Genie start after memory location 5800 Hex, and are stored as shown in table 3.

The first two bytes contain the address of the next line. These are followed by two bytes containing the line number, followed by the Basic statement, and the end of the line is marked with a zero. If you use the program for listing 1 to look at itself, you will see what I mean. For start address type 22528 — any end address will do. You can hold the display by pressing Shift.

Listing 2 will copy any part of memory you wish and place each value into a neat data statement for you. When it is finished, all you need to do is delete the lines above the data statements and type your program after or before the statments. If you write a machine code subroutine it will even copy that, so you can POKE it into memory from your program.

The program starts by asking for the start and end addresses of the area in memory you want transferred to Data Statements. The first part of the program deals with saving the simple variable space. To copy the memory into data we have to make room for the new program lines, but as you can see from the memory layout, the simple variable list follows right on the tail of our Basic program, and if we expand the program we will destroy this area.

The program gets over this by first PEEKing the address at 40F9 Hex which contains the pointer to the simple variable space and end of Basic program pointer. This data is then saved along with other relevant values in lines 10060-10090, The new end of program is calculated in lines 10120-10160 and the value of 110 is calculated by looking at the way Basic is stored: 2 bytes for pointer to next Line+2 bytes containing line number + (26 data statements of 3 bytes each)+25 bytes for ',' + 1 byte for end of line marker + 1 byte for data token and 1 byte for space (see lines 10260-10270).

The RUN 10190 restores the variables by PEEKing into the locations we saved them in during the first part of the program. The program searches for the end of line marker, then searches for the next end of line marker. After incrementing itself 3 bytes past this, it finds the last line number used by our previous program and increments this to be the first line number of our data statements.

After a successful execution of 'memory grabbing' you will be confronted with the READY sign. If you now list your program, you will find a neat set of data statements. All you need do now is DELETE 10000 — 10530 and you are left with just the data. You can now type your own program in front of these statements (that's the reason for the high program numbers), and re-read the data with a loop eg: FOR I = nnnn TO nnnn: READ L:POKE I,L: NEXT, *nnnn* being the start and end address of where you want to POKE your data.

Don't be worried if the screen freezes during the creation of data statements, as with a long 'data grab' the basic program will take quite a while.

Listing 1

```
10 DEFINT A-Z:DIM L
20 CLS:COLOUR7
30 INPUT"STARTING ADDRESS";SA
40 INPUT"ENDING ADDRESS";EA
50 CLS:FL=0
60 FOR L=SA TO EA
70 PK=PEEK(L)
80 GOSUB200
100 NEXT
110 PRINT:INPUT"ANOTHER RUN?";A$
120 IF A$="Y"THEN GOTO 150
130 END
150 INPUT "SAME ADDRESSES";A$
160 IF A$="Y" THEN GOTO 50 ELSE GOTO 20
200 IF PK<33 GOTO 250
210 IF PK>122 GOTO 250
220 IF FL=0 COLOUR4:PRINTL*::COLOUR8:
    PRINT" ";:COLOUR6:PRINTCHR$(PK);
    :GOTO240
230 COLOUR6:PRINTCHR$(PK);
240 FL=1:RETURN
250 GOSUB300:COLOUR4:PRINTL*::COLOUR8:
    PRINT" ";:COLOUR6:PRINT PK
260 FL=0
270 RETURN
300 IF FL=1 THEN PRINT:RETURN
310 RETURN
```

Listing 2

```
10000 DEFINTA-Z
10010 CLS
10020 INPUT"START ADDRESS";SA
10030 INPUT"END ADDRESS";EA
10040 LE=(EA-SA)+1
10050 GOSUB10120
10060 V=SA:X=&H4144:GOSUB10460
10070 V=LE:X=&H4142:GOSUB10460
10080 V=BE:X=&H4140:GOSUB10460
10090 V=NB:X=&H413E:GOSUB10460
10100 POKE&H40FA,PEEK(&H413F):POKE&H40F9,
      PEEK(&H413E)
10110 GOTO10190
10120 BE=PEEK(&H40F9)+256*PEEK(&H40FA)
10130 Z=INT (LE/26)*110
10140 O=LE-INT(LE/26)*26
10150 IF O>0THEN Z=Z+6+O*4
10160 NB=BE+Z
10170 RETURN
10180 RUN 10190
10190 DEFINT A-Z:DIMI.N.J.A.X.Y.PK
10200 GOSUB10420:SA=SA-1
10210 FORI=1TOLE STEP 26
10220 A=I-25*(I+25<=LE)-(LE-I)*(I+25>LE)
10230 LN=LN+1
10240 PT=NL+2:V=LN:X=PT
10250 GOSUB10460
10260 T=PT+2:POKET,136
10270 POKET+1,32
10280 T=T+2
10290 FORJ=1TOA:PK=PEEK(SA+J)
10300 G=1000
10310 FOR N=1TO3
10320 G=G/10
10330 DS=INT(PK/G)
10340 POKET,DS+48
10350 T=T+1
10360 PK=PK-DS*G
10370 NEXT
10380 POKET,ASC(",");T=T+1:NEXTJ
10390 EM=T-1:POKEEM,00
10400 V=EM+1:X=NL:GOSUB10460:NL=T:NEXTI
10410 V=0:X=NL:GOSUB10460:END
10420 SA=PEEK(&H4144)+256*PEEK(&H4145):
      LE=PEEK(&H4142)+256*PEEK(&H4143):
      BE=PEEK(
&H4140)+256*PEEK(&H4141)
10430 GOTO10490
10440 LN=PEEK(EM+3)+256*PEEK(EM+4):NL=BE-2
10450 RETURN
10460 H=INT(V/256):POKEX+1,H
10470 LW=V-INT(V/256)*256:POKEX,LW
10480 RETURN
10490 FOR EM=BE-4 TO BE-260 STEP-1
10500 IF PEEK(EM)=0THEN RETURN
10510 NEXT EM
10520 PRINT"SOMETHING WRONG NO MARKERS
      FOUND !"
10530 STOP
```

Camilla Martin looks at a briefcase-size portable with tape and printer from Sharp.

Portable micro looks Sharp

The first thing that strikes you about the new Sharp MZ 731 portable is how few pieces it consists of. It's made of lightweight, durable plastic, and comes as a standard keyboard with integral plotter, speaker and cassette recorder.

The whole ensemble is some 17in by 3in at the back, the height tapering to a couple of inches at the front. It's highly portable, weighing less than the average briefcase, and is easily tucked under the arm.

Documentation

The manual provided is adequate, and includes the now fashionable cartoons to lighten the subject matter.

For the first time user there is an extensive briefing in S Basic with explanations of each function, and an appendix listing reserved words. However, the format of this section brings up the debate about how best to instruct a beginner. You could get them used to making their particular type of machine work — in this case cassette loaded programs and the commands specific to Monitor 1Z-03A — or you could teach them the rudiments of the structure behind storage and retrieval of information.

If you feel strongly about the latter, perhaps because you intend to upgrade to a less portable but more powerful machine later, then this won't be the tool for you.

The Basic has its own monitor program which greatly extends the power of the machine by allowing you the use of machine code programs, and which has a text editor that follows the same type of screen editor as Basic. This familiarity will cause few problems — although it is not extensively documented. Neither are the machine code commands and a novice programmer might well find the sample program completely baffling. I think it assumes perhaps too much knowledge on the part of its readers.

Construction

The Sharp is up to the usual high construction standards of Japanese products, and comes as a single, compact unit. At the top left hand corner, next to the plotter and cassette recorder, is a three inch square ventillation grill. The speakers for the internal sound are located underneath this. Sound for these is controlled via Basic commands.

There are nine major sockets and connections on the back of the machine, including a power switch, colour on/off switch, a fine-tuning colour trimmer, a reset button and a volume control for the speakers. The latter is a little exposed, and difficult to manipulate.

There are two metal plates screwed onto the back, behind which are the printer and I/O sockets. The I/O appears to be a bus, but is actually a board edge connector rather than a proper connector. On the left hand side there are two sockets for connecting your TV/monitor to. The first is labelled 'video' and give rather wobbly displays towards the bottom of the screen, together with fairly dodgy colour. The other, labelled 'RF', gave a stable screen and clear colour.

In between the TV sockets are the channel volume switch and the colour on/off switch. Next door to the recess housing these four is an RGB signal output DIN connector for use with the Sharp MZ 1D04 monitor. Beneath these outputs are the read and write sockets supplied to connect to any standard external tape recorder. On the right of these is a plastic covered connection socket allowing joysticks to be connected.

The on/off switch is handily positioned on the extreme right of the machine's rear, the reset being less well-placed more centrally on the back-plate. The machine also has a Frame Ground terminal output just below the power socket. Sharp has clearly left little to chance as regards I/O. The RF, however, does not allow you to send sound through your TV set.

Keyboard

The keyboard has the standard qwerty format, but it is dominated by one horrendous problem. It is rigged with shift the wrong way round, so characters come out caps locked unless you ask them *individually* not to. To do this you use the shift-function key . . . which you can't lock. This is no doubt handy for Basic programming, but useless for text writing. It's no surprise that there's no mention of word-processing in the manual.

In addition to the ordinary but upside down shift, there are two further shifts which allow access to a wide range of block graphics, two per key. There are five blue function keys at the top left, and a cluster of four cursor keys to the right of the main keyboard. The break key is situated at the top right, safely out of harm's way.

Immediately below the tape deck the delete key is raised larger than life in a separate batch of two keys above the rest. The keyboard itself has several modes of operation. It can be used for text editing, and then switched over to graphic characters, which are depicted on the left side of the front vertical face of each key.

Use shift with this mode and you will see the character shown on the right side of this face. It sounds alarming, but all graphic options are actually visible at all times, despite this description.

To switch from one mode to the other two keys are added — Graphics and Alpha. Alpha denotes alphanumeric, in case you were wondering, although 'text' might have been easier to understand to the uninitiated. At the top are the five 'function' keys which can be set to any definition by use of the DEF KEY Basic statement explained in the manual. Initially they will be preset to certain common commands, such as RUN+CHR$(13) [carriage return], LIST and AUTO, which are programmed when Basic is loaded into memory.

Screen

Eight colours (excluding black and white) are available — the seven colours of the rainbow excluding orange, with pale blue replacing violet. But blending routines can be developed to allow a far, far wider range of shades to be produced. There seems to be somewhere in the region of 100 of these available.

A demonstration program called 'Openings' is supplied with the machine, and this shows off the graphics, sound and most particularly the colour capabilities superbly. Within the Basic listing is encoded a call to an assembler subroutine for overlaying the eight colours in turn to produce subtle shades, but there is no documentation of this in the manual.

In order to set any of the colours, you first have to set four parameters — an x and y coordinate for the character, the character colour and the background colour, in the format COLOR (or COL.) X,Y,C,B, where C and B represent numbers specified in the manual.

If you wish to specify a colour for all characters, a comma bypasses the unnecessary coordinates (eg COL. ,,C,B). You can set the display colour alone by typing COL.,,C,, and the background by typing COL.,,,B.

Storage

A cassette recorder with the standard key format is built-in on the top right hand side

The front of the Sharp MZ 731 (above) shows the keyboard layout and the integrated speaker, plotter and cassette deck from left to right across the top. The close-up of the cassette deck (right) shows how compact it is, despite its taking standard audio cassettes. Below it can be seen the insert and delete keys and the power light.

of the machine. It's operated simply by typing LOAD then pressing play. It seems fairly reliable, and every tape I tried loaded first time. However, the cassette operating system — if it can be called that — is very weak.

There is no provision for anything more than the most rudimentary of filenames, no header block which could be used as a directory, or anything in the way of motor control.

There's no mention of disk drives coming up — indeed 'or floppy disk' had been carefully inked out in the review manual — and there's very little information on add-ons in general, or recommendations about the software that can be run on the machine. The review 731 came with just two short cassettes housing three programs, including the Basic language. The implication appears to be that you should create your own!

Plotter

The plotter/printer is the only part of the initial setting up that might cause problems, and unfortunately the relevant section is placed in the middle of the book. The index points the way of course, but it would surely have been better to have this piece nearer the closely-related section which talks you through starting up the machine, particularly as every encouragement is made to use the printer right through the manual.

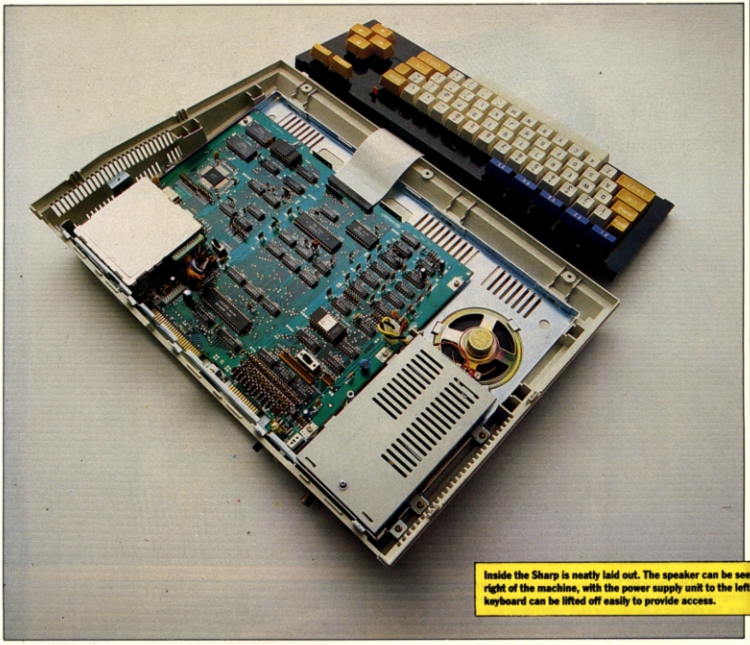
As it is, I'd barely executed a couple of programs before I was itching to try the plotter. This consists of a small print-head that looks like a bundle of pencils, and is capable of producing 80,40 or ten character widths in four different colours, blue, black, green and red. It prints onto continuous paper which feeds back through a slit beyond the cover. Printing with the cover in place is therefore feasible — a nice touch.

If you leave the pens unused for a couple of days or so, they seem to have a tendency to dry up. You then have to remove them (using the eject lever described in the manual) and use them by hand to get them going again. The principle of the swivelling print head seemed to work well, though perhaps not in the manner you'd expect

When commanded to swop colours part-way through the line, the head scuttles back into the recesses at the left, and there twirls to present a new pen, accompanied by noises like a small creature feeding, before sliding back out to its previous position.

However, I gave it some hours worth of printing to cope with, and it didn't falter. It is capable of graphics, but trying to print

28▶



Inside the Sharp is neatly laid out. The speaker can be seen to the right of the machine, with the power supply unit to the left. The keyboard can be lifted off easily to provide access.

◀27

out graphics forms in text mode leads to the Hex equivalent being sent across in a different colour (usually blue). When using the printer in graphics mode, repeated lines may well become rather blurred, apparently due to the use of ball-pens, so double line spacing is advisable.

The commands to switch the printer between text and graphics modes are simple directives such as: M. TS to mean text, and M. GR for graphics. Similarly, there are easy commands for selecting which coloured pen should follow (black is the initial one) telling the printer to LIST some program or PRINT a string, for example: PCOLOR 3, LIST/P, PRINT/P (with various length settings).

In all cases there are abbreviated formats, like PC. 3. The manual encourages its readers to use at least the text printer as soon as possible. After listing a couple of programs on the printer you are ready to tackle the mysteries of graphics.

Here the manual is not so kind. From sitting distractedly looking from book to screen (which always breaks concentration) and half anticipating the simple leading in functions, you are pulled up with a lurch to find talk of relative coordinates and relative distances from variable origins.

Operating System

Since the computer is referred to by the manual as 'clean', meaning that no language is fixed into the memory when you switch on, it is necessary to pick up the rudiments of the operating system. This is a small (4K) program, sitting in ROM, which has a very few actual commands. Those it has must be augmented by calls to machine code subroutines.

It is called Monitor 1Z-013A, not to be confused with the Basic monitor program, and its call-instruction set is to be found a good way through the manual in chapter five. There is a useful index of these calls in the appendix, along with notes on the general use of software and hardware.

Under the Monitor function it is possible to address the machine's memory directly, at the same time calling in predefined routines. At the very back of the manual are several pages concerned with Z80A assembler listing, its instruction set and the program list with comments.

Expansion

As far as connecting external devices is concerned, the chapter which offers guidance on connecting to a monitor display or TV set goes on to discuss the other peripherals. In turn it spells out clearly what to plug in where for a separate printer or cassette recorder, often referring to its own makes of each. The software/hardware notes at the back of the book issue warnings about using other makes.

However, on the wiring side, the manual assumes other sources of information will be available and merely provides an unexplained configuration signal diagram further on. This is set amongst circuit diagrams which are a bonus for the technically minded, but overall I do not think enough information has been provided to make the going easy for add-ons.

Verdict

The market I feel the Sharp has been designed for is the keen beginner, or the first time buyer who has a little experience of Basic program writing. For both it holds out the promise of developing their techniques while keeping the format simple, with the minimum of add-ons.

As portables with their own printing devices go, I liked this little machine. It looks stylish, surpassing the 'tinniness' of

30▶

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Hewson: ☐ ... ☐ ... ☐ ...

Bug-Byte: ☐ ... ☐ ... ☐ ...

Imagine: ☐ ... ☐ ... ☐ ...

Ocean: ☐ ... ☐ ... ☐ ...

Interceptor: ☐ ... ☐ ... ☐ ...

Virgin: ☐ ... ☐ ... ☐ ...

Artic: ☐ ... ☐ ... ☐ ...

Micromega: ☐ ... ☐ ... ☐ ...

Anirog: ☐ ... ☐ ... ☐ ...

Abersoft: ☐ ... ☐ ... ☐ ...

Shepherd: ☐ ... ☐ ... ☐ ...

Gremlin: ☐ ... ☐ ... ☐ ...

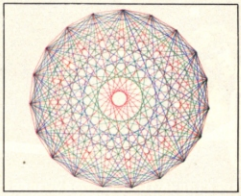
Durell: ☐ ... ☐ ... ☐ ...

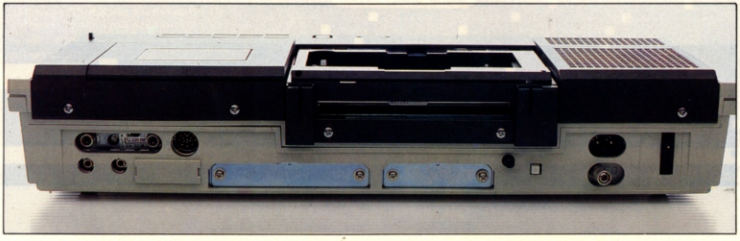
Dk'Tronics: ☐ ... ☐ ... ☐ ...

Software Projects

◀28 metallic coloured models, and it doesn't feel too light and brittle.

It is potentially a fairly versatile machine, but it would be wise to bear in mind the fact that there seems to be little software available at present. Until this changes, it's therefore likely to be more suitable for the enthusiast.





The printer plotter (top), the rear of the machine, showing the printer and I/O bus (centre), and a close-up of the tape deck in action (right).

SPECIFICATIONS

Machine Sharp MZ 731 with built-in cassette and colour plotter

Price £419.85
Processor Z80A
RAM memory 64K
ROM memory 4K plus 2K character generator
Text format 40 × 25, 8 colours
Keyboard 59 keys plus five functions and four cursor keys
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Mice currently seem to be crawling out of all sorts of places. Ian Scales tells the hole story.

Light mousework

The 'mouse' concept represents the latest attempt by the micro industry to make it easier for the non-computerised to learn application programs quickly and easily. The traditional means of communicating with a micro via a qwerty keyboard has proved to be one of the obstacles to making micros 'friendly' items to use.

Hardly an ergonomically inspired device to start with, the qwerty keyboard suffers from the stigma of secreterial association. In other words, executive types would just as soon be seen washing out the morning tea cups as working in front of a keyboard — let alone (perish the thought) actually touch-typing on one.

Even discounting this slightly nearndertal outlook, there has to be a better and friendlier way of selecting program options than typing something along the lines of CTRL XXR — not only is this a fairly meaningless procedure in relation to the function finally executed, but using a package with this sort of approach to the user's control means spending at least the first few weeks constantly referring to the handbook to see what to do next.

As the technology advances it's become possible to make the typical applications programs (financial modelling, database systems and so on) so menu driven that the user is almost limited to answering yes or no to a series of options. In other words, the daunting 64-key board is being underutilised, so it seems sensible to develop a different method for entering commands.

The mouse concept is ultimately an attempt to convert the abstract way a computer goes about doing things to a concrete representation on the screen.

Ikonography

The premier mouse product so far is Apple's Lisa (see *PCN issue 1*). Here the entire set of applications packages is based around a conceptual desktop. By manipulating the mouse, the cursor is positioned over one of a number of 'ikons' scattered around the perimeters of the screen.

The ikons are little pictures of everyday office paraphernalia which represent the various functions of the software — there is a calculator and a waste bin, for instance. You position the cursor over the calculator by moving the mouse, then push a button on the mouse to load the 'calculator' software. Once you've run off a few quick sums you may want to get rid of the file you've created, so you position the cursor over the waste bin, press the button again and the file is immediately despatched into the void.

The Lisa mouse can also control just about every other function (drawing, deleting, defining screen areas) except the actual entering of text or numbers — for this job it's back to the keyboard again. The mouse is only one component in the Lisa system of integrated applications packages and the hardware built to run them.

It is very much a flagship product for Apple and the steep price tag (around £10,000 for a complete system) reflects the fact that the company doesn't expect it to challenge Sinclair in volume sales. But the Lisa has set a new standard of excellence which the industry as a whole can be expected to try to emulate, albeit in a more modest form.

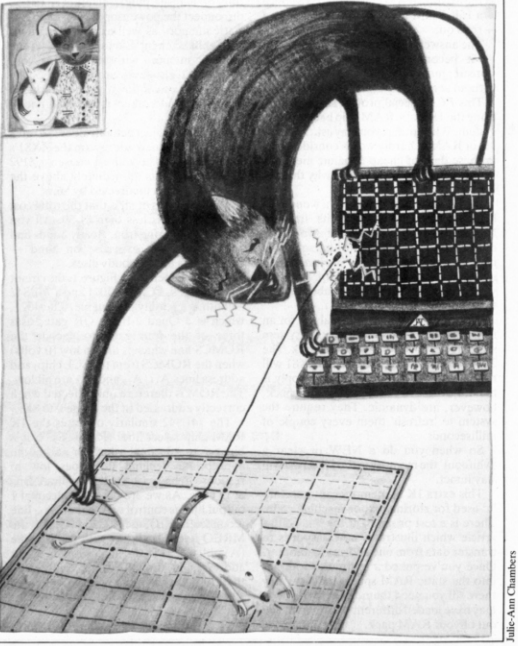
Mouse 'standard'

The IBM PC seems to have been identified as a good place to start. Mice for the PC have become very popular lately, at least with manufacturers. But how useful is a mouse as a relatively isolated add-on to a system which was designed to function through a qwerty keyboard?

The problem is, of course, that the applications packages you are likely to be using with a mouse haven't been designed for it.

One supposes that a mouse 'standard' may eventually emerge if one of the mouse manufacturers takes a lead in the market. But for the time being, at least, this is an unlikely development. This leaves the user with the task of configuring the packages. This is no problem in itself, as the mice come with utilities which enable you to do this fairly easily. But it does mean that you are party to a fairly hefty compromise, because the software you are using doesn't take advantage of the hardware's possibilities.

Is it all a big mousetrap? We try to find out by grappling with two mice for the IBM PC in next week's *PCN*.



Julie-Ann Chambers

If you expand your ZX81 you lose the original 1K of memory. KP Taylor reveals how to get it back.

Sinclair surgery

This feature represents a departure for *PCN*. It's an electronics project for the ZX81. We'd like to be able to say that any ZX81 owner could undertake it at the drop of a hat, but without running a 200-page feature on electronics as an introduction we can't guarantee that you can.

However, if you're interested in getting to grips with electronics, or you know something about the subject already, this is a cheap, useful and relatively simple project for the Model T Ford of micros — the ZX81. If you can't already understand the language in the main article that follows, it probably won't be a good idea to try and to it without help, or without further research. We suggest that you either con an electronically-minded friend into standing-by in case you need help, or you put this article aside while you fill yourself in on a bit of background.

There are a number of books available which could provide some of the answers. At the top of the list is *20 Simple Electronic Projects for the ZX81 & Spectrum*. This is available from Interface Publications (44-46 Earls Court Road, London W8 6EJ). It presents 20 electronic projects, including a burglar alarm, a ZX81 numerick eypad and an analogue-to-digital converter.

The way you go about putting these electronic projects together is clearly explained and well-illustrated, but more importantly for our purposes, a wealth of general electronic information is passed on, both in the introductory chapters and during the explanations to the projects themselves. What's more, most of the information relates directly to the ZX81.

The Explorer's Guide to the ZX81 (Timedata Ltd, 16 Hemmells, Laindon, Basildon, Essex) could be another valuable addition to your library. This book covers ZX81 programming aids, lists a few games and looks at applications and machine code. But it also features a chapter on the ROM and the hardware generally which may be some help.

Yet another book called *Explorer's Guide to the ZX Spectrum and ZX81* (not to be confused with the one above) provides much the same sort of information, although it does have to divide its attention between the two ZXs (this one costs £5.95 and is available from Addison-Wesley, 53 Bedford Square, London WC1B 3DZ). It has a chapter on interfacing a computer to the outside world, including a section on an elementary introduction to digital electronics.

If you've ever wondered what happens to the existing RAM chip in the ZX81 once a 16K RAM pack has been configured — read on.

The answer is that nothing happens to it — it becomes another unemployment statistic, just sitting there eating up power without serving any useful purpose.

This *PCN* special project allows you to bring the 1K static RAM chip back into the system. Why bother, you may ask. After all 1K of RAM is hardly worth consideration in these days of cheap dynamic memory. But there are several reasons why this can be a worthwhile project.

First, it's annoying to have a wonder of high technology twiddling its thumbs. More importantly, this could be your first introduction to veroboard and soldering iron, and undertaking the project should increase your understanding of the ways your computer actually goes about doing things.

There is also a good practical use for an isolated chunk of static memory in a system which relies on a dynamic RAM pack. The 2114 static memory used in the ZX81 will retain data as long as the power supply is maintained. The chips in the RAM pack, however, are dynamic. They require the system to 'refresh' them every couple of milliseconds.

So when you do a NEW or clear a 'whiteout' the memory in the 1K RAM will stay intact.

This extra 1K of memory can therefore be used for storing text or machine code. There is a test program at the end of this article which illustrates how easy it is to transfer data from one address to another. Once you've poked a routine or routines into the static RAM space, they can stay there till you need them, even though you may have loaded different programs in and out of your RAM pack.

Part of the project involves the construction of a reset plug (remember, if you disconnect the power supply you lose your static memory as well as your dynamic). This enhancement allows you to reset the dynamic memory without affecting your 1K RAM. It also saves wear and tear on the plug as the conventional physical reset, so commonly undertaken, is no longer necessary.

What the project actually does is to give the 1K RAM a new address on the ZX81's memory map. The address chosen is 8192 to 9216, which is immediately above the ROM in an area unaffected by 'new'.

The best news of all is that the total cost of the project is less than £1.50. All you need is a soldering iron, steady hands and some electronics expertise on hand — either yours or somebody elses.

As can be seen from Figure 1, the circuit uses two IC's, a CMOS 4071 and a 74LS42 — both are readily obtainable. The 4071, which is a Quad 2-Input OR gate, uses three of the four gates to decode the ROMCS line which is driven low (0 volts) when the ROMCS from the SCL chip, and address lines A_{13}, A_{14} and A_{15} are all low. The ROM is therefore only selected when correctly addressed in the range 0 to 8K.

The 74LS42 similarly operates the 1K RAM chip select line. (RAMCS). It is a binary to decimal decoder and the appropriate decimal line goes low in response to highs (+5 volts) on the A,B,C & D lines. As we are using the decimal 1 output line as control we need the A_{14} line (connected to B), the A_{15} line (C) and the MREQ line (D) all low with the A_{13} line (A) high. This is the sequence for addresses in the 8K to 9K range and therefore the memory will be activated whenever an address in this range is requested.

The Z80 processor in the ZX81 has a RESET pin which is normally held at +5 volts. It is connected to the supply via a 220K ohm resistor and has a lmfd capacitor to 0 volts. This generates a delay at switch-on and ensures that the main power is on before the reset pin goes high, thus initiating the restart proceedure. It is only necessary to momentarily take this pin low to activate the reset and the button does this by discharging the capacitor to 0 volts with a 100 ohm resistor.

Construction

The two IC's are mounted in sockets — one 14-pin and one 16-pin — attached to a piece of DIP Veroboard about 30mm square. If this isn't available, any 0.1in spaced board without copper connectors can be used, but make sure it fits within the case. There is no layout for this board and the IC wiring as it can be connected using the information and pin numbering on Figure 1.

Don't forget the power to the two IC's and for safety connect the unused inputs of the 4071 to 0 volts as shown. Use any thin wire for connecting to the computer board but if stranded wire is used make sure a stray end doesn't short across. Connect to the Sinclair board as shown in Figure 2, making the connections where possible at an eyelet hole when the wire can be pushed through before soldering. When the wires connect to a resistor, slip a short length of suitable sleeving of insulating tape over the joint to prevent it shorting out.

Carefully cut the RAMCS print going to the edge connector as shown. Make sure you cut the print line going to the edge strip or you will disconnect the RAM. Completely remove the 680 ohm resistor (R2) connecting the SCL (Pin 12) to this line and make sure the wire from the 74LS42 (Pin 2) connects to this line near the print cut and joins to the RAM's (Pin 8).

If you have any difficulty determining

the correct hole for any of the lines indicated in Figure 2 remember most of them are brought out to the edge connector and there is a connection diagram of this in chapter 26 of the Sinclair Basic Manual. Using this it is possible to trace back along the print lines to find the eyelet hole indicated.

Drill a suitable hole in the top half of the case for your press button. On the right hand side, opposite the modulatorcoax socket slot, is a good place and is out of the way of the keyboard ribbon but make sure it misses the board fixing pillar. Solder the 100 ohm resistor to one pin of the button and connect the wires as shown. Use wires that are long enough to allow the board to be lifted sufficiently to permit the keyboard ribbons to be connected to their sockets.

Secure the new IC board by sticking pieces of sponge plastic to its corners or edges and trimming these so they are gripped by the two halves when the case is assembled.

Testing and Use

After fitting these modifications there should be no indication at switch-on and the computer should start up as normal. Now type some characters on the screen and press the reset button. The screen should go blank for a few seconds and then only the cursor should appear, indicating that the reset procedure has been carried out.

You now have a very quick means of clearing the computer ready for a new LOAD.

Next enter the following program:

```
1 REM THIS IS THE NEW MEMORY
 5 LET X=22
 10 FOR M=0 TO X
 20 LET Y=PEEK (16514+M)
 30 POKE 8192+M,Y
 40 NEXT M
100 FOR N=8192 TO (8192+X)
110 PRINT N;"  ";CHR$ PEEK N
120 NEXT N
```

Now RUN this program and the printout lists the characters stored at each address of the new memory. The program is of course in two parts. Lines 10 to 40 loads the new memory and lines 100 to 120 lists it and either can be used alone. Line 5 defines the number of characters and when writing a code into the first REM statement this number can easily be worked out from the data in store on the first program line. This can be determined best by entering immediately after the REM program line,

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the following line: PRINT (PEEK 16511+256*PEEK 16512) −2

When this is entered with Newline the number of characters will be printed out for you.

When machine code is loaded into the REM it should be moved to the new memory before it is run. Then if it crashes press the reset button and try again. There may be no need to move the code back — usually if it can be used above Ramtop then it has no absolute addresses and can be run from the new memory position. The only change is to alter the start address to USR 8192.

Remember that although there is only 1K of memory this is much more than the computer originally had because then it had to allocate some of its store space for system variables, the display file etc. You are now able to use the total 1024 locations and in machine code this a reasonably extensive program.

Other versions

The preceeding details and the layout in Figure 1 refer to the Sinclair 'Issue One' board which seems at present to be the most common. If your board is a later type it could still be modified providing it has the 2114 memories. These are usually marked MCM 21L14 P30 or PD 2114LC or just 2114L−.

You will, however, have to work out the new connecting points for your board using the edge connector data mentioned earlier. This will be unchanged and should enable you trace the connections required.

Parts Required

1—CMOS 4071	14p
1—74LS42	30p
2—Sockets (14 & 16 pin)	28p
1—Press Button	18p
1—100ohm Resistor ¼w	4p
1—.01mfd Capacitor	4p
Total	98p

1—Small piece of Veroboard is also required.

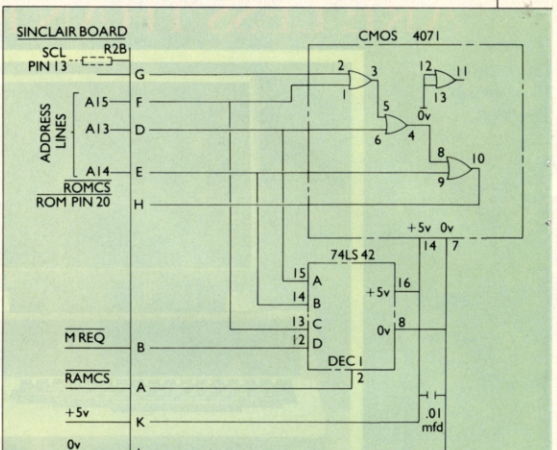

Figure 1: This is a circuit diagram of the board you will construct for the interior of your ZX81. The chip at the top is a CMOS4071. The one below it is the 74LS 42. The two chips can be mounted in sockets (one 14-pin and one 16-pin) on a piece of DIP veroboard about 30mm square.

Make sure you board sits in the case before you go ahead with the construction. When you connect these lines to the ZX81 make sure that any stranded wire doesn't short across the tracks. Connections should be made at an eyelet hole where possible.

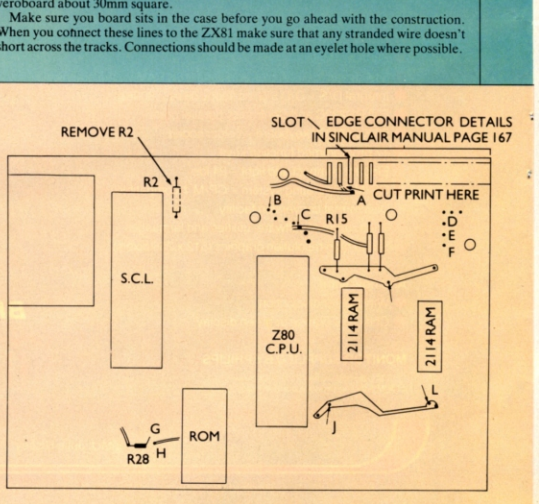

Figure 2: Here, you are looking down on the top of the Sinclair board. The letters on the diagram indicate where the wires from your own board should be connected. Pay careful attention to the details of the diagram — remember, if in doubt consult someone who knows more about electronics before you start delving around the innards.

Also remember to make your wires long enough to allow you to lift the top of the casing once everything is inside. This will also make it easier to get everything into the right places to begin with.

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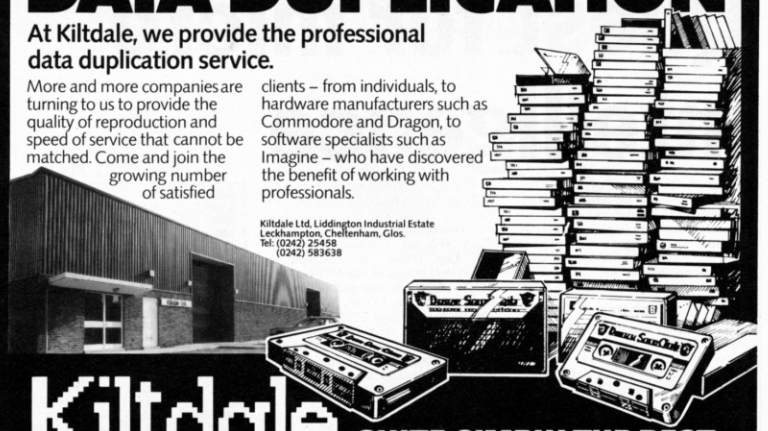

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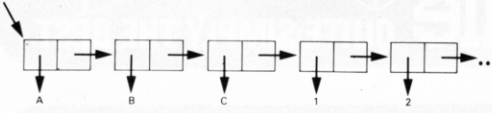
Ted Ball tests Acornsoft's Lisp, the AI language now available for the 32K BBC Micro.

Quest for micro intelligence

Lisp was the first programming language designed for Artificial Intelligence and is still the most widely used. Acornsoft Lisp is an implementation for the BBC Microcomputer with 32K of RAM and is available on cassette or disk. The cassette version was supplied for review and was tested on a BBC Model B.

Features

Lisp is short for List Processing. Everything in it is either an atom (a primitive item like a number or a name) or a list. You can have lists of atoms, lists of lists, and lists containing atoms and lists. Even a Lisp program is in the form of a list.



Although a list may seem a very simple data structure it is widely applicable. For example, you can regard a language as being built up from them, a word being a list of letters or sounds, a sentence being a list of words, etc. The files used in data processing can be regarded as lists of records, with records being lists of fields, fields being lists of subfields, etc. Lisp also provides powerful functions that allow you to build up any kind of data structure.

There is no standard for Lisp, only a number of different implementations, which vary in detail but are similar in their fundamental features. Acornsoft Lisp is close to the most widely used versions and you should have no difficulty in adapting programs in other dialects.

It contains about 100 built in functions, which is typical for a small Lisp system, although there are mainframe Lisps with several hundred functions. All the usual functions are included: LIST, CAR, CDR, CONS, DEFUN, COND, etc. Arithmetic is limited to integers from −32768 to +32767 and you get an error message if the result of an operation is outside this range. This limitation is not important as you do not normally need more than this in the applications Lisp is used for.

There are functions in Acornsoft Lisp that allow you to make full use of the BBC Microcomputer and its operating system. PEEK, POKE, and CALL, which work similarly to the same functions in Basic, allow low level access to the computer. VDU allows you to use all the VDU calls that are available from Basic, and allows you to use operating system functions like *KEY, *FX, etc. You have to use these with Lisp syntax. For example (* 'MOTOR1) instead of *MOTOR1.

Other functions that are not usually found in Lisp are LOOP, WHILE and UNTIL. WHILE and UNTIL, however, work differently from how you would expect. Normally a WHILE statement must be placed at the beginning of a loop and if the associated condition is false when the loop is encountered the statements in it are not executed at all. UNTIL must be placed at the end of the loop and the statements in it will always be executed at least once. In Acornsoft Lisp, however, both WHILE and UNTIL may be placed anywhere in a loop, and the difference between them is that WHILE terminates the loop when its condition is true and UNTIL terminates the loop when its condition is false. This is so different from the normal usage of these words that it can almost be called a bug.

ADD1	AND	ADVAL
APPLY	ASSOC	ATOM
BAND	BLANK	BNOT
BOR	CALL	CAR
CDR	CHARACTER	CHARCOUNT
CHARP	CHARS	CLOCK
CLOSE	COND	CONS
CR	DEFUN	DIFFERENCE
DOLLAR	EDIT	ENVELOPE
EOF	EQ	ERROR
ERRORSET	EVAL	EXPLODE
F	FSUBR	GCTIME
GET	GETCHAR	GREATERP
IMPLODE	LAMBDA	LESSP
LINEWIDTH	LIST	LISTP
LOAD	LOOP	LPAR
MAP	MAPC	MESSOFF
MESSON	MINUS	MINUSP
MODE	NIL	NOT
NULL	NUMBERP	OBLIST
ONEP	OPEN	OR
ORDINAL	PEEK	PERIOD
PLIST	PLUS	POINT
POKE	PRIN	PRINC
PRINT	PRINTC	PROGN
PUT	QUOTE	QUOTIENT
READ	READLINE	RECLAIM
REMAINDER	REMPROP	RPAR
REPLACA	RPLACD	RESET
SAVE	SED	SET
SETQ	SOUND	SUBRP
SPRINT	T	TIME
TIMES	UNDEFINED	UNTIL
USR	VDU	WHILE
WRITE	WRITEO	XTAB
ZEROP		

Functions provided in Acornsoft Lisp.

Presentation

The cassette comes in a printed box, and there is also a 38-page booklet entitled *Lisp Glossary*.

The Lisp interpreter is recorded on one side of the tape only. It loads in several sections which go into different parts of memory, and it seems very difficult to make a back-up copy.

The booklet, *Lisp Glossary*, contains definitions of the functions included in Acornsoft Lisp and some simple examples of their use and there is not enough information in the booklet to allow even an experienced Lisp programmer to use Acornsoft Lisp properly. In order to get the essential extra details, the most important being what the error numbers mean, you have to buy a separate book published by Acornsoft, *Lisp on the BBC Microcomputer*, by Arthur Norman and Gillian Cattell.

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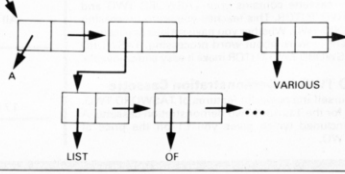

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The book is a good introduction to the language and explains the fundamental features with short examples you can type in to see how they work. Later in the book there are a number of sample application programs with explanations of how they work. Some of these are complete programs, like the sorting program and the animal guessing game. While others, like the section on parsing computer languages just give a very brief introduction and are intended to give you an idea of how Lisp can be used in such applications. There is also an appendix that gives codes you can type in for some Lisp functions that are not built in to Acornsoft Lisp. This includes a TRACE function you can use in debugging your programs.

There are some small differences between the explanations of the Lisp functions in the book and the booklet, mostly a matter of details mentioned in one and not the other. However, there are about a dozen functions described in the book that are not included in the Lisp on the tape. Possibly these are intended to go into later versions, but there is nothing to tell you that these functions are not available.

In use

Acornsoft Lisp is interpreted, and functions are evaluated and the values printed on the screen when you type them in, similarly to immediate mode in Basic. A Lisp program consists of function definitions that use the built in functions and other user defined functions. If you made a mistake when typing a definition you can type in a new, corrected, definition with the same name which will replace the original one.

There is also an editor which allows you to correct a definition by altering the incorrect part, but this is very difficult to use.

Reliability

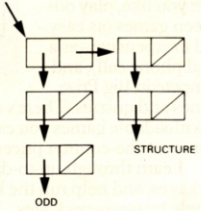
Acornsoft Lisp is generally very reliable and gives useful error messages, but there are a few bugs. When it has loaded you have to set the screen mode (3 to 7, as the interpreter takes up too much space to allow modes 1 and 2) before you can start programming. If you later try to change to a screen mode that uses more memory for the screen (with VDU 22) the machine will hang up, ESCAPE will not work, and Lisp cannot be restarted after BREAK.

There are also some problems with *FX calls from Lisp. The Lisp version of *FXO is (* 'FXO), and this gives you error number 247, although valid error numbers are from 0 to 27. Other *FX calls that I tried did give the correct results with correct parameters but gave invalid error numbers with incorrect parameters.

Verdict

Acornsoft Lisp is fairly close to other implementations of Lisp and you should have little difficulty using it with any of the standard textbooks. You will not be able to get any serious programs into the memory available on the BBC Microcomputer — real Artificial Intelligence programs typically consist of hundreds of thousands of lines — but Acornsoft Lisp is adequate for learning the language and the principles of Artificial Intelligence.

The Acornsoft textbook is a good introduction and you will need to buy the book even if you already know Lisp, as it contains some essential details that are not included in the reference booklet.



Acornsoft Lisp is rather expensive considering that the booklet that comes with it is inadequate and the information in the booklet is mostly included in a separate book that you must pay extra for to be able to use it properly. But allowing for the limitation of memory size it is about as good as you can expect on a small microcomputer.

RATING

Features
Documentation
Performance
User interface
Reliability
Overall value

Name Acornsoft Lisp **Application** Artificial Intelligence Programming Language **System** BBC Microcomputer with 32K RAM **Price** Cassette £16.85, Disk £19.90, Textbook £7.50 **Publisher** Acornsoft Ltd, 4a Market Hill, Cambridge CB2 3NJ **Format** Cassette or disk **Language** machine code.

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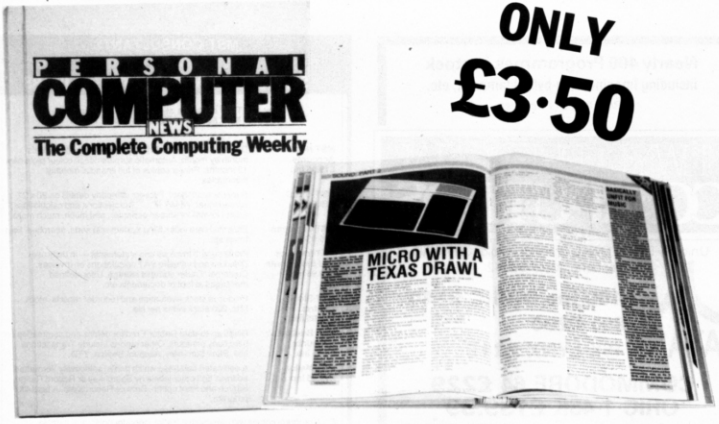

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Need a better editor for your Apple? Cliff McKnight looks at an offering from Lostock.

Apple editor enhanced

If you actually write programs on your Apple between bouts of Alien Slaughter, then you will know that to err is human, and to edit is a little tedious. The Lostock Screen Editor aims to ease the editing process.

Features

Once you've booted the disk a title page appears — the editor is now installed. When the normal flashing cursor appears you can start entering your program (without typing NEW, because the hello program is automatically deleted). When you notice a mistake on a previously-entered line, typing Ctrl-W invokes the editor. At this point, the normal cursor alternates with an 'underline' cursor, which can be moved to the offending line. Movement keys are Ctrl-W, A, S and Z, although the standard Esc-I, J, K and M are also available if your old habits die hard.

Moving the forward-arrow key to the beginning of the offending line allows new copy to be entered. Incorrect characters can be replaced, and there is a useful 'copy to end of line' command if your mistake was near to the beginning of a long line. if the long line contained strings or REMS you will also want to use Ctrl-Q to ensure that the spurious spaces are correctly handled by resetting the margin.

An additional feature is the auto line number facility. This allows you to specify the start line and the increment. Pressing 'space' at the beginning of a line automatically produces the next line number.

The editor can be disconnected using IN 0, and can be reconnected in three ways: pressing reset, typing '&' from Applesoft, or typing 'Ctrl-Y' from the monitor.

Presentation

The Editor disk and accompanying A5 manual arrived in the kind of plastic bag common to games programs, *ie* just narrow enough to stop you getting them out without bending. The manual is clear and concise and contains useful basic information about the package, including its position and approximate size in memory.

The disk is write-protected because you would probably want to transfer the editor to your own disks. But there is a lot of space on the disk; less than one track is used and another three are used by DOS.

In use

The editor is easy to use, and there are so few commands that most people shouldn't experience memory-strain. The use of Ctrl-W, A, S and Z means that all cursor movement can be achieved with the left hand, leaving the right hand free to operate the arrow keys for copying and deleting.

The auto line numbering is also easy to use. Pressing 'space' at the beginning of a line gives the next line number, but you are still free to enter 'in-between' line numbers. This means that subroutines which you like to start with particular numbers can still have their identification REMS on the line before.

Reliability

With so little to do, what can go wrong? Not much, but there are a couple of problems. First, if you have enabled the auto line number facility but (through force of habit, like me) actually type the next line number, pressing 'space' at the start of the next line will produce the same number. This is not catastrophic, because even if you press return, thereby deleting the line, you can recapture it with the editor.

Also, if you have typed the main body of your program and now want to start numbering subroutines at your favourite large number, you must switch off the auto line feed and switch it on again. This allows you to reset the starting line number.

The second problem is one which many Apple users will have encountered. If a program is interrupted after a 'flash' command has been issued, attempts to edit will produce garbage. Since this is such a well-known problem, it would be nice if the editor automatically coped with it. However, it doesn't, so garbage will still be produced in this situation.

Other than this, the editor is very reliable. Because it sits between DOS and the DOS input buffers, it is reasonably safe from accidental damage. Even a Ctrl-B from monitor, which will often zap your program while returning you to Basic, leaves this section of memory intact. However, many commercial packages also take advantage of this spec, so the editor is only really recommended for use with your own programs.

Verdict

At £14.90 inclusive for the Editor and £18.35 for the Editor plus auto line number option, this package will only appeal to the real beginner who is struggling with the Apple's slightly awkward editing 'features'. People with some programming experience will either cope with the system as it is, or write a three-line program to use the ampersand hook to POKE 33,33 automatically. It *is* nice to have an auto line number facility; the question is whether or not you're prepared to pay for it.

RATING

Features	★★★
Documentation	★★★
Performance	★★★
Usability	★★★★
Reliability	★★★★
Overall value	★★

Name Lostock Screen Editor **Application** Screen Editor **System** Apple II+/IIe **Price** Editor: £14.90. Editor + auto line: £18.35 (both prices inclusive) **Publisher** Lostock Software, 13 Cranborne Close, Lostock, Bolton, Lancs BL6 4JG **Format** Disk **Language** Applesoft/machine **code Outlets** mail order

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ZX SPECTRUM

Robot rampage

Name Zip-Zap **System** Spectrum 48K **Price** £5.50 **Publisher** Imagine, Masons Buildings, Exchange Street East, Liverpool L2 3PN **Format** Cassette **Language** Machine code **Other versions** None **Outlets** Mail order, Smiths, Boots, Menzies, most dealers

They may be good or bad, but Imagine's games are guaranteed to be different, which sometimes makes them difficult to describe. Zip-Zap has you controlling a robot floating around in outer space, avoiding aliens and gathering four fuel cells which enable you to transport to the next sector. There the whole business starts all over again with different-shaped aliens. The aim, of course, is survival and high scores, for which there is a record.

Objectives

The robot you control is a Buddha-like figure that is beamed down a hollow column of light, otherwise known as the Tele-portal system. Once that has retracted you are floating about on a screen that is swimming with aliens, and which also contains the four fuel cells you must collect together. For once this is a game where you have only one life, and you survive for as long as you have energy left. You start the game with 99 units, indicated near the top-centre of the screen, and as this gets low your speed of movement is reduced, but energy is replenished slightly as you complete each sector.

In play

The aliens can be either shot or avoided by maneouvering . . . I would have said nifty maneouvering, but neither keyboard nor joystick offers you too much control over your robot.

If you want it to head in a particular direction you must try and stop it rotating at just the right point, when it will come out of its circling and go forwards in a straight line till you rotate it again. It's difficult enough trying to explain this in writing, but doing it is even worse.

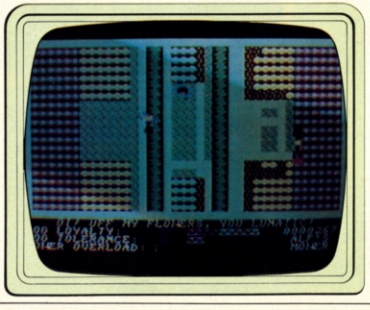
The graphics are first class, there's no doubt about that, with 32 different types of aliens as you progress through the screens, which I only managed courtesy of a special review copy which permits such a feat.

Verdict

Outstanding graphics unfortunately don't make up for the lack of control you have over your character. Why on earth there couldn't have been a straightforward up-down-left-right movement to avoid the nasties and get about the screen I don't know.

Mike Gerrard

RATING	
Lasting appeal	
Playability	
Use of machine	
Overall value	



ZX SPECTRUM

Skyline skirmish

Name Zzoom **System** Spectrum 48K **Price** £5.50 **Publisher** Imagine, Masons Buildings, Exchange Street East, Liverpool L2 3PN **Format** Cassette **Language** Machine code **Other versions** None **Outlets** Mail order, Smiths, Boots, Menzies, most dealers

Never one to do anything by half, Imagine opens this new game with nothing less than the Dam Busters' March. This can be forgiven as the company has produced an outstanding piece of software which is somewhere between a flight simulation and a 3D Defender.

Objectives

The aim is to use your five lives to notch up a high score by shooting down tanks and boats and planes while simultaneously saving refugees on the ground. Initially it looks rather complicated to play, with the instruction sheet describing protective shields, long-range scanners and something called an attitude scanner. This isn't a revolutionary new inter-active device to tell you whether your heart's really in the game, just a misprint.

In play

But in play, the game is simple. The keyboard can be used, but all you really need is a joystick to control movement and to fire, and if you don't have a joystick (several types have been catered for) then this is probably the game to make you go out and buy one.

You are in the cockpit of an aircraft, the Ground Skimmer, and about to set out on your mission to protect the little men who run about on the ground and occasionally stand and shake their fists at the heavens. Your protective shields are slowly lost under the continual barrage of fire, and when they disappear completely it's an automatic nose-dive into the ground and a lost life. You also lose lives, of course, by careless flying and hitting the deck yourself.

The first screen starts you above a scrolling landscape, the opposition being aircraft, which fly across the screen or zoom towards you in very realistic 3D fashion. Survive this and you're in the desert, with palm trees and tanks sweeping towards and under you as you skim over the sand. Wipe out the tanks and you're over the sea with a fleet of ships to sort out. By the time you reach the screens which combine planes and tanks or planes and ships your work is really cut out.

Verdict

Black marks for incomplete instructions.

But that apart, the speed of the game, its sound, and especially the 3D graphics, are all superbly done, and this is one of only a handful of games around that could truly be said to be of arcade standard.

Mike Gerrard

RATING	
Lasting appeal	
Playability	
Use of machine	
Overall value	

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Another box of ZX tricks, and Shirley Fawcett squares up to fend off mutants and pulsoids.

Spectrum special

A handy little machine, the Spectrum — especially when it comes to saving the world. This current batch of new Spectrum games includes no fewer than three different opportunities to rescue this planet from a fate worse than . . . and all in the privacy of your own home.

ANDROID ONE

The best of this batch by a very short head is Android One: The Reactor Run, from the Vortex stable. This proclaims itself to be just the first of a series of Android adventures, Horace-style — and rightly so, I think, since this game is going to make its way well up the charts.

The plot is nothing new — in fact, this is really a souped-up version of Berzerk. You have to charge through a heavily guarded enemy mutant warren in search of their reactor — which has to be destroyed, since it is about to . . . yes, end the world.

No problem, though — for you are in control of Android One, the Very Latest in Android Technology. How can you fail?

The graphics in this epic are faultless, and it is a very superior version of the old game. In place of robots to pot-shot, you are faced with four different kinds of mutants, all of which have different ways of moving about the screen and are worth different numbers of points if you do manage to pot them.

Groupies travel in groups of three or four. Wanderers potter about by themselves, generally.

Bouncers spring up and down the screen and can't be killed, but they can kill you perfectly well when they land on your head. Skaters slither unpredictably around, and are fiendishly difficult to hit.

This is an unreasonably addictive game. There are five levels of play, and at even the slowest there's enough of a challenge to keep you screen-glued and bug-eyed. There's a long and varied series of chambers to explore, with random layouts of obstacles to get round each time.

You control your android by rotating it till it's facing the way you want to go and then running like the clappers.

This one will run and run and run.

JUNGLE TROUBLE

A close second to that one is Jungle Trouble, a Durell Software extravaganza. It's a mini obstacle course *à la* Miner 49er, but the objective is simply to get out of the jungle as fast as possible. You are a little explorer . . . three little explorers, in fact, since you get three chances to be eaten by crocodiles or hit by a falling tree.

You first have to collect an axe, then leap across a set of stepping stones in a river filled with crocodiles. Once on the other side you climb a ladder to get to the trees — rather cuddly oak-like things, these, and standing in a neat row. Oh well, who wants realism in their games?

You have to chop down the trees, remembering to get out of the way as they fall. But you will have to go back to the start at least once, since monkeys will steal your axe unless you manage to swipe them with it before it gets too blunt. Even then, it will get blunt just from tree-felling, so you'll have to fetch another.

Then, once you've done your bit to reduce the great wild places of the world, you climb another ladder and swing on a rope across a firepit, take a flying leap over a yawning chasm, and run for home. Eat your heart out, Tarzan!

SPAWN OF EVIL

Back to saving the world, or galaxy, with Spawn of Evil by Dk'Tronics. What a title — just calls out to be said in a sinister Vincent Price voice. The cover is pretty lurid, too, with a queue of green amorphous blobs advancing on you through the trackless wastes of space. Great stuff.

The game itself doesn't quite live up to the title's promise, mostly because it isn't easy to get the hang of operating your spacecraft. There's an excellent set of instructions on the second side of the tape, which you can dump to a printer if you have one — there's a lot to remember.

In a nutshell, you have to beat the living daylights out of a — wait for it — Ectogenetic Galactic Gamete, the First Stage of a Breeding Process that produces Mature and Dangerous Aliens! If you hang about, you'll also have to shoot its offspring: pulsoids, cycloids, aliens, that sort of thing.

Pulsoids fuse with each other to produce cycloids. Cycloids do the same, to produce aliens. Aliens are green and amoeba-shaped, and fuse to produce more gametes. Gametes wait till they number three, then turn the aliens loose on you in seek-and-destroy mode. In this mode, the brutes spit at you until your windscreen is filled with red goo and you are destroyed. Nasty!

Yes, there's plenty to cope with in this game, but the overall effect is just a bit incomprehensible. You have two viewer screens, one to show you a wide-angle view of approaching clusters of creatures, the other to give you a close-up of what's coming at you. You have to flip between the two, and shoot at the ones you manage to get in your sights.

Since the ship slides through space at odd angles, this isn't easy — and the keys you control it with are not at all easy to use, being S, D, Q, and A, and F to fire.

All in all, good graphics, shame about the game. Maybe it would be better with a joystick.

BOZY BOA

Bozy Boa, from CDS Micro Systems, is a bit of a puzzler. What does bozy mean? Sort of boozy and dozy? Anyway, this turns out to be a predictable and unambitious little game, the sort of thing you might choose to play for half an hour on a wet winter Sunday afternoon.

It's no more than a competently done version of that old game where you steer a snake around the screen gobbling numbers, and each time you catch a number, your tail gets longer — and you mustn't bump into it, or any of the walls and obstacles.

Bozy Boa's only novelty value is the fact that it is set in an English country garden, as the little tune at start-up tells you. And your boa has to eat beetles, snails and things that look like red dice but are in fact ladybirds, while avoiding the flowers — more of which grow each time you get your fangs into a beetle.

The cross-eyed snake on the cassette cover is the best thing about this one.

HIDDEN CITY

Hidden City is yet another earth-saving mission, from Bytewell. This time, you have to pilot a ship into the underground alien cities which now infest the earth, and destroy them with a single well-placed shot in the reactor.

Your ship, says the instructions, can 'Penetrate all known alien defences' — even the parts other ships cannot reach? — as long as you pilot it properly. You have to get through three screens — a cliffside, down which you fly to reach the cavern entrance under fire from three guns; a maze, from which you have to pick up cans of fuel; and the underground tunnel itself, in which cities and various odd satellites are scattered.

I found this one unimpressive. There are several levels of play, level 1 being slow enough to be usable as a practice mode and level umpteen being one long history of being shot at and shooting — but the graphics are fairly crude and it's too easy to get through the various screens, at least at the slower speed levels. Probably worth a few hours' play if you like that sort of thing, though.

KAMIKAZE & GOPHER

Block-Byte Computing is a very modest little company. 'Arcade games used to be boring,' screams the title screen. 'Then came Block-Byte, to make them an EXPERIENCE!!!!!!' Then came Block-Byte, maybe, but one of the two offerings on this tape, Kamikaze and Gopher, is the dullest thing I've played for months. The other kept me up till 3am — but I beat it in the end.

'Gopher is the one. It doesn't look like anything special — just move up, down and across the screen to eat a random bunch of dots and avoid white blocks, till you manage to score 450 or run out of time — but the level of difficulty is just right.

You can see your score getting close, you begin to get the hang of the best strategy to eat the maximum number of dots in the minimum time, but it still takes a while before you actually reach the 450 mark. When you do, your reward is a tune. ∴ and the chance to do it all over again.

As for Kamikaze . . . well. It's filled with bugs, and crashed at the end virtually every time. You have a rectangle which is supposed to be an aircraft's windscreen, a horizontal line across the screen, and one or two objects in the air which are supposed to be enemy aircraft. You can scroll left or right, and using the symbol key is supposed to speed up the scrolling (but has no perceptible effect).

You can shoot at the enemy but my gun didn't work most of the time.

At the end of this magical experience you get a snatch of *Those Magnificent Men in their Flying Machines*, and the following message: 'You're score was PATHETIC' (*sic*). So is the game.

Android One — The Reactor Run (£5.50) — Vortex Software, 26 Crawford Road, Hatfield, Herts. **Jungle Trouble** (£5.00) — Durell Software, Castle Lodge, Castle Green, Taunton, Somerset. **Spawn of Evil** (£5.50) — Dk'Tronics, Unit 2, Shire Hill Industrial Estate, Saffron Walden, Essex. **Bozy Boa** — CDS Microsystems. **Hidden City** (£5.95) — Bytewell, 203 Court Road, Barry, South Glamorgan. **Kamikaze** and **Gopher** — Block-Byte Computing, 213 Stainbeck Road, Leeds.

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The TI Home Computer has got the memory power you might expect from more expensive computers, built in. At its heart is a powerful TMS 9900 16-BIT Microprocessor. Most other home computers have only an 8-BIT. And you can expand the memory from 16K of RAM up to 52K.

The total memory capacity is 114K Bytes.

A wide range of software for everyone

Another feature that makes the TI system so powerful, yet so easy to use is Solid State Software.™ These plug-in cartridges cover everything from space games like Parsec™ to teaching maths, managing home finances and composing music. And the range is getting wider all the time.

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A DOG'S LIFE

COMMODORE 64

One man and a dog

Name Hover Bovver **System** Commodore 64 **Price** £7.50 **Publisher** Llamasoft, 49 Mount Pleasant, Tadley, Hants RG26 6BN **Format** Cassette **Language** Machine code **Other versions** Spectrum version from Quicksilva soon **Outlets** Various dealers

You'll just give the lawn a quick once-over with neighbour Jim's hover mower. Off you go with faithful mutt Rover trotting gently at your heels. A Sunday afternoon, calm and peaceful. But wait! Here comes Jim, wanting his mower back. Rover barks and chases him. Whoops! You've just mown a prize flower bed and the gardener is after you.

Objectives

Having borrowed Jim's Air-Mo, you start to tackle 16 different lawns. The first swathe is barely cut when Jim decides he wants his mower back. Mowing like fury, you must dodge round flower beds and hedges to avoid him. Being a bit nervous, Jim always keeps his distance from Rover. If he gets close, set Rover on him to drive him back. Unlike Lassie, Rover becomes disobedient when the noise of the mower gets on his nerves. He'll try to bit the machine and you may end up mowing Rover.

If you mow too fast, the mower cuts out and you're forced to wait while it cools. While you mower is not powerful enough to drive through a hedge, it happily ploughs up flower beds.

Naturally, this offends the sensibilities of a nearby gardener who, believing you to be all kinds of a lunatic, rushes to grab the mower from you. Although Rover won't chase him, the gardener will flee if Rover barks.

Jim is no respecter of gardens either and will trample across the flower beds to get at his mower. Rover and the gardener are nature lovers — they will only cross flowers beds on any path you may have ploughed through the beds. If Jim or the gardener catch you, they stride off with the mower, but you can always nip over and borrow Tom's and then Alf's.

In play

The game opens with an animated title page, accompanied by an impressive 'English Country Garden' type tune. This merrily burbles away throughout the game but you can turn it off by pressing the Commodore logo key and M. Pressing these keys again brings back the music.

The game starts showing you ambling up to Jim's house to filch his mower from the garage. The garden is then displayed complete with you, mower and Rover but Jim soon appears on the scene and the fun begins.

Your joystick controls the mower speed and movement; pressing the fire button causes Rover to start barking and chasing Jim and the gardener will head for the horizon when Rover barks. Mowing over Rover causes the poor thing to run yelping away.

The sound and graphics are superb. Any of the first seven gardens are selectable by pressing the F1 key. Progress to the 16th garden depends on your skill, each garden becoming more difficult to mow. Gardens 9-16 force you to mow across a flower bed, incurring the gardener's wrath.

Speeds also increase but there are compensations — Rover goes after the neighbour like a bullet. You finally remain in garden 16 but with everything getting faster each time.

A freeze-action facility is provided and you can have one or two player games; the latter can be with two joysticks. The top five scores, with players initials, are kept.

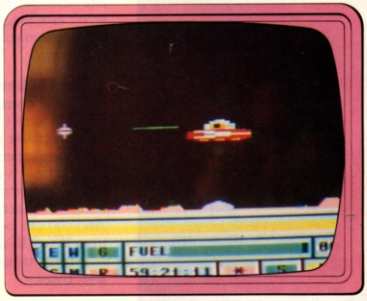
Verdict

Playing this game is like taking part in a Keystone Kops movie. Easily the funniest game I've ever seen and what's more it's original, compulsive and nobody gets killed. Irrestistible!

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of Machine	
Overall Value	



COMMODORE 64

A hound in space

Name Benji — Space Rescue **System** Commodore 64 **Price** £18.23 **Publisher** Epyx Inc, Sunnyvale, California **Format** Disk **Language** Machine code **Other versions** None **Outlet** Mapsoft Ltd, Unit A, Oak Road South, Hadleigh, Benfleet, Essex SS7 2BB, tel: 0702-554002

Can arcade games be educational? This one certainly tries hard to be. It lets you captain a spaceship around the galaxy, rescue kidnapped boffins, shoot up a few aliens, control supplies, navigate the ship, learn about planets, and nip back to Earth in time for tea. All this, and a dog called Benji, in an interesting Star Trek-type program.

Objectives

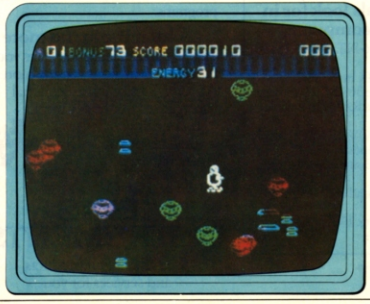
The game is aimed at the 10-14 year age range although younger and older children are likely to enjoy parts of it. A dog, Benji, is at the helm of the spaceship Star Woof (but don't let that put you off — it's a good game). Some scientists are being held captive on other planets in the galaxy.

You have to fly with Benji to the rescue and bring them back safely. The lowest skill level has Benji taking over all computations from you; at the highest, Benji relinquishes everything to you. There are elements of education, decision making, memory training, and hand and eye co-ordination skills embodied in the game.

In play

A hi-res picture of Benji and a catchy tune start off the game, asking you to select from eight levels of rank. The higher the level, the larger the number of scientists, problems and computations. The screen shows your spaceship console. On the right are the display areas: message panel, fuel, altitude, speed, time, etc. On the left are the console push buttons for communications and commands. The rest of the screen is

56 ▶



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◀ 54

the console window.

A cursor passes over each button in response to your joystick. Pressing the joystick Fire button presses the screen button. For example, the console E button causes the engine room to respond and the window to display various data. Joystick movement sets the destination, warp speed and distance (at lower levels, Benji sets the last two for you).

Although the game is far easier to play with joysticks, it can also be controlled from the keyboard. The joystick is replicated by a 'diamond' layout using the A,D,W,X keys with function key 7 as fire button.

Each department is called by its initial letter — T for transporter room, E for engine room, W for weapons etc — and each call is confirmed by a message, scrolled across the screen telepinter-style, requesting your orders.

You can summon a status report, select destination and speed, and a variety of other options open to galactic superheroes.

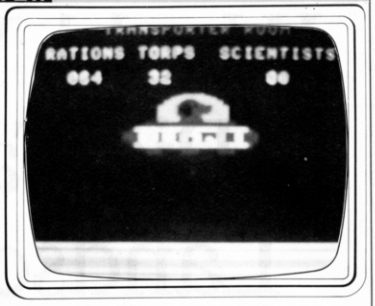
Anyone familiar with the old Star Trek computer games will feel immediately at home with this one.

The variety of difficulty levels, set by the rank of Benji, ensures that the game will sustain its level of interest. With Benji in almost total control it can be rather boring, but when he takes a back seat it is almost impossible.

The transporter room shows the amount of food, fuel, torpedoes and rescued scientists on board. You can beam up more supplies provided you are the right distance from a planet that has such supplies. The weapons room controls the ship's defences.

A hi-res picture of any of the planets can be obtained, together with basic planetary data (genuinely taken from NASA photos and references).

The time taken to fly between two planets reflects the speed and distance. Stars are seen hurtling past the console window to a great rushing sound. If the calculations are wrong, the ship misses its destination and an asteroid storm has to be negotiated. On reaching the planet, the ship can be taken down to the planet surface.



Loud klaxons alert you to the presence of any aliens and a simple but splendidly graphic arcade-type battle ensues. Scientists are rescued by flying low over a likely looking hideaway and hovering there while beaming them up, with alien ships buzzing around you.

Up and away to the safety of space, you need to check supplies for the trip back to Earth.

A detailed booklet contains the instructions, as well as plenty of helpful facts and figures.

Verdict

The game has a wealth of detail and is enjoyable to play. It requires thought, planning and co-ordination. My two children, a boy and a girl, loved it. My guess is, so will lots of others — their parents too.

RATING	
Lasting appeal	
Playability	
Use of machine	
Overall value	

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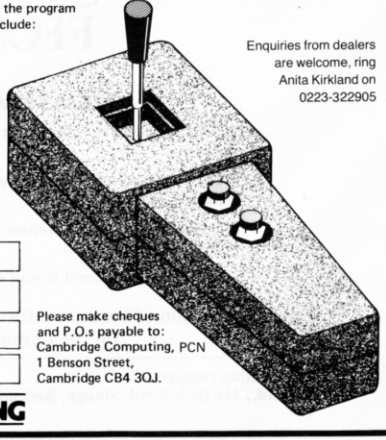

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Gridrunner is an arcade game requiring one joystick.

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Salamander Software

PCN ProgramCards

ProgramCards this week offers you two new programs, one for the Commodore 64 and the other for the Lynx 48K. This week also sees the completion of the Dragon game — Asteroid Lander.

SID sings

The Musical Keyboard program for the CBM 64, from H K Sabavala of London, demonstrates the use of the sound generator (SID).

This device is not quite as good as the computer of the same name in Gerry Anderson's UFO, but it can be used to warn you of incoming aliens.

The program turns your Commodore into a musical keyboard with nine instruments. The tones of the various instruments are created by poking W (54276) with the correct waveform value. A summary of these values is given in *PCN* Micropaedia, issue 26. A little imagination needs to be used to recognise some of the instruments, but these can be altered if desired.

Foot for thought

The other program this week is from Lee Wilson Wolfe, also of London. It runs on the Lynx 48K and demonstrates the machine's user defined graphics. It creates a picture of a well-known political personality. Unfortunately the duffel coat is missing, but you can't win them all! The listing contains a lot of data statements, but the quality of the picture is well worth the effort of typing them all in.

The program also shows off the Lynx's video controller chip (6845) by scrolling the whole screen horizontally. When the program is run, there will be a pause while the characters are redefined, after this the pictures are drawn. The program then waits for a key to be pressed before scrolling commences.

To stop the program, ESC should be used, and to return the picture to its proper position, OUT &0087,0 should be entered. If the program is run several times in a row the computer will run out of memory. So after the program has been RUN once it should be restarted from line 30.

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Musical Keyboard Card 1 of 3

8327MK1/3

```
0 GOSUB200 POKE53280,0 POKE53281,12 PRINT"□"
1 POKEV,15 POKEL,0 POKEH,0 PRINT"□"
2 PRINT"
3 PRINT"
4 PRINT"
5 PRINT"
6 PRINT"
7 PRINT"
8 PRINT"
9 PRINT"
10 PRINT"
CORDIAN"
11 PRINT"
12 PRINT"
15 GET B$ IF B$="" THEN 15
16 GETA$
18 IFB$="P"THENGOSUB100
20 IFB$="F"THENGOSUB106
22 IFB$="B"THENGOSUB112
24 IFB$="H"THENGOSUB118
26 IFB$="O"THENGOSUB124
28 IFB$="C"THENGOSUB130
30 IFB$="T"THENGOSUB136
32 IFB$="R"THENGOSUB142
34 IFB$="X"THENGOSUB148
40 IFA$="Q"THENPOKEH,34:POKEL,75:GOSUB90
42 IFA$="2"THENPOKEH,36:POKEL,85:GOSUB90
44 IFA$="W"THENPOKEH,38:POKEL,126:GOSUB90
46 IFA$="3"THENPOKEH,40:POKEL,200:GOSUB90
48 IFA$="E"THENPOKEH,43:POKEL,52:GOSUB90
50 IFA$="R"THENPOKEH,45:POKEL,198:GOSUB90
52 IFA$="5"THENPOKEH,48:POKEL,127:GOSUB90
54 IFA$="T"THENPOKEH,51:POKEL,97:GOSUB90
56 IFA$="6"THENPOKEH,54:POKEL,111:GOSUB90
58 IFA$="Y"THENPOKEH,57:POKEL,172:GOSUB90
60 IFA$="7"THENPOKEH,61:POKEL,126:GOSUB90
62 IFA$="U"THENPOKEH,64:POKEL,188:GOSUB90
64 IFA$="I"THENPOKEH,68:POKEL,149:GOSUB90
66 IFA$="9"THENPOKEH,72:POKEL,169:GOSUB90
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CBM 64
Commodore Basic

Application: Music
Author: H K Sabavala

A=Attack/decay, V=Volume, S=Sustain, W=Waveform, H=Pitch, L starts sound

0	Set border to black and background to grey
1	Set volume level and turn off existing notes
2-11	Give choice of instrument and keys used for keyboard
12-15	Get instrument
16-34	Select subroutine to set up appropriate instrument
40-82	Select and set frequency

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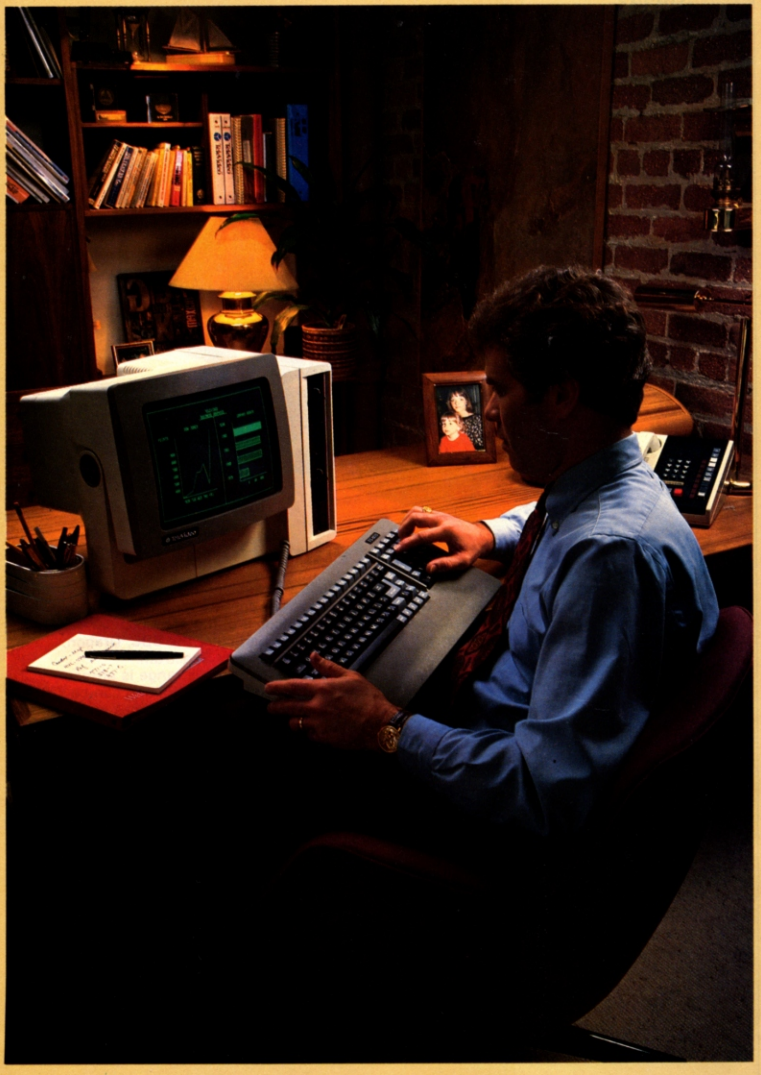

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PCNProgramCards

Musical Keyboard Card 2 of 3

8327MK2/3

```
 68 IFA$="O"THENPOKEH,76:POKEL,252:GOSUB90
 70 IFA$="0"THENPOKEH,81:POKEL,161:GOSUB90
 72 IFA$="P"THENPOKEH,86:POKEL,105:GOSUB90
 74 IFA$="@"THENPOKEH,91:POKEL,140:GOSUB90
 76 IFA$="-"THENPOKEH,96:POKEL,254:GOSUB90
 78 IFA$="*"THENPOKEH,102:POKEL,194:GOSUB90
 80 IFA$="£"THENPOKEH,108:POKEL,223:GOSUB90
 82 IFA$="↑"THENPOKEH,115:POKEL,88:GOSUB90
 84 IFA$="N"THENGOTO1
 85 IFA$="F"THENPOKEH,0:POKEL,0:END
 86 GOTO16
 90 POKEH,0:POKES,0:POKEW,0:POKEL,0
 94 RETURN
100 POKEH,9:POKES,0:POKEW,65
103 POKE54275,0:POKE54274,255
105 RETURN
106 POKEH,64:POKES,128
107 POKEW,17
110 RETURN
115 POKEH,130:POKES,0
114 POKEW,17
116 RETURN
118 POKEH,9:POKES,0
120 POKEW,33
122 RETURN
124 POKEH,0:POKES,240
126 POKEW,33
128 RETURN
130 POKEH,0:POKES,240
132 POKEW,17
134 RETURN
136 POKEH,96:POKES,1
137 POKEW,33
140 RETURN
142 POKEH,102:POKES,0
144 POKEW,17
146 RETURN
148 POKEH,9:POKES,0
150 POKEW,17
152 RETURN
```

84	Select new instrument?
85	End program?
86	Keep playing and get next key, at line 16
90-94	Turn off note subroutine
100-105	Sound setting for piano
106-110	Flute
112-116	Oboe
118-122	Harpsichord
124-128	Organ
130-134	Caliope
136-140	Trumpet
142-146	Accordion
148-152	Xylophone

PCNProgramCards

Musical Keyboard Card 3 of 3

8327MK3/3

```
200 V=54296:A=54277:S=54278:W=54276:H=54273:L=54272
201 POKE53280,0:POKE53281,0:POKEL,0:POKEH,0:POKEW,0
202 PRINT"■■■
```

PCN ProgramCards

Foot — Card 1 of 4

8327F01/4

Lynx 48K
Lynx Basic

Application: Graphics
Author: Lee Wilson Wolfe

```
10 PROTECT 0
20 RESERVE HIMEM-329
30 CLS
40 DPOKE GRAPHIC,HIMEM
50 FOR N=0 TO 329
60   READ A
70   POKE LETTER(128)+N,BIN(A)
80 NEXT N
90 DATA 000000    330 DATA 111111  570 DATA 111111  810 DATA 000000  1050 DATA 001111
100 DATA 000000   340 DATA 111111  580 DATA 111111  820 DATA 000000  1060 DATA 100111
110 DATA 000000   350 DATA 111111  590 DATA 000000  830 DATA 000000  1070 DATA 110000
120 DATA 000000   360 DATA 111111  600 DATA 000000  840 DATA 000110  1080 DATA 110110
130 DATA 000000   370 DATA 111111  610 DATA 110000  850 DATA 001110  1090 DATA 111111
140 DATA 000000   380 DATA 111111  620 DATA 111100  860 DATA 001101  1100 DATA 111111
150 DATA 000000   390 DATA 000000  630 DATA 111110  870 DATA 001101  1110 DATA 111111
160 DATA 000000   400 DATA 111111  640 DATA 111111  880 DATA 000100  1120 DATA 111111
170 DATA 000000   410 DATA 111111  650 DATA 111111  890 DATA 011111  1130 DATA 111111
180 DATA 000000   420 DATA 111111  660 DATA 111111  900 DATA 111111  1140 DATA 111111
190 DATA 000000   430 DATA 111111  670 DATA 111111  910 DATA 111111  1150 DATA 111111
200 DATA 000000   440 DATA 111111  680 DATA 111111  920 DATA 111111  1160 DATA 111111
210 DATA 000000   450 DATA 111111  690 DATA 000000  930 DATA 001111  1170 DATA 111111
220 DATA 000001   460 DATA 111111  700 DATA 000000  940 DATA 000001  1180 DATA 000111
230 DATA 000011   470 DATA 111111  710 DATA 000000  950 DATA 000000  1190 DATA 111111
240 DATA 000111   480 DATA 111111  720 DATA 000000  960 DATA 110111  1200 DATA 111111
250 DATA 000111   490 DATA 000000  730 DATA 000000  970 DATA 110111  1210 DATA 111111
260 DATA 001111   500 DATA 111100  740 DATA 000000  980 DATA 110111  1220 DATA 111111
270 DATA 001111   510 DATA 111111  750 DATA 100000  990 DATA 111111  1230 DATA 111111
280 DATA 011111   520 DATA 111111  760 DATA 100000  1000 DATA 111111 1240 DATA 111111
290 DATA 000000   530 DATA 111111  770 DATA 110000  1010 DATA 111111 1250 DATA 111111
300 DATA 000001   540 DATA 111111  780 DATA 110000  1020 DATA 111111 1260 DATA 111111
310 DATA 011111   550 DATA 111111  790 DATA 000000  1030 DATA 111111 1270 DATA 111111
320 DATA 111111   560 DATA 111111  800 DATA 000000  1040 DATA 111111 1280 DATA 111111
```

10	Enable all colour banks	40	Point to character set		statements in 90-3380
20	Reserve memory for characters	50-80	Define 33 characters from data	90-3380	Data for character definitions

PCN ProgramCards

Foot — Card 2 of 4

8327F02/4

```
1290 DATA 111111  1620 DATA 011011  1950 DATA 111110  2280 DATA 000000  2610 DATA 000000
1300 DATA 111111  1630 DATA 101011  1960 DATA 111110  2290 DATA 111111  2620 DATA 000000
1310 DATA 111111  1640 DATA 111011  1970 DATA 011100  2300 DATA 111111  2630 DATA 000000
1320 DATA 111111  1650 DATA 111111  1980 DATA 011111  2310 DATA 111111  2640 DATA 000000
1330 DATA 111111  1660 DATA 111111  1990 DATA 111110  2320 DATA 111111  2650 DATA 000000
1340 DATA 111111  1670 DATA 111111  2000 DATA 011110  2330 DATA 111111  2660 DATA 000000
1350 DATA 111111  1680 DATA 001111  2010 DATA 101110  2340 DATA 111111  2670 DATA 000000
1360 DATA 111111  1690 DATA 110111  2020 DATA 111101  2350 DATA 111111  2680 DATA 000000
1370 DATA 111111  1700 DATA 100111  2030 DATA 011101  2360 DATA 111111  2690 DATA 100000
1380 DATA 111111  1710 DATA 001111  2040 DATA 011101  2370 DATA 011111  2700 DATA 000000
1390 DATA 110000  1720 DATA 111111  2050 DATA 011100  2380 DATA 110001  2710 DATA 000000
1400 DATA 010000  1730 DATA 111111  2060 DATA 111100  2390 DATA 111111  2720 DATA 000000
1410 DATA 010000  1740 DATA 111111  2070 DATA 111000  2400 DATA 111111  2730 DATA 000000
1420 DATA 000000  1750 DATA 111111  2080 DATA 111000  2410 DATA 111111  2740 DATA 000000
1430 DATA 000000  1760 DATA 111111  2090 DATA 100000  2420 DATA 111111  2750 DATA 000000
1440 DATA 000000  1770 DATA 111111  2100 DATA 110000  2430 DATA 111111  2760 DATA 000000
1450 DATA 000000  1780 DATA 111111  2110 DATA 010000  2440 DATA 111110  2770 DATA 000000
1460 DATA 000000  1790 DATA 110000  2120 DATA 010000  2450 DATA 111100  2780 DATA 000000
1470 DATA 100000  1800 DATA 111111  2130 DATA 000000  2460 DATA 100000  2790 DATA 000000
1480 DATA 100000  1810 DATA 111111  2140 DATA 000000  2470 DATA 000000  2800 DATA 000000
1490 DATA 001111  1820 DATA 111111  2150 DATA 000000  2480 DATA 000000  2810 DATA 000000
1500 DATA 000111  1830 DATA 111111  2160 DATA 000000  2490 DATA 111100  2820 DATA 000000
1510 DATA 000011  1840 DATA 111111  2170 DATA 000000  2500 DATA 111100  2830 DATA 000000
1520 DATA 000001  1850 DATA 111111  2180 DATA 000000  2510 DATA 111000  2840 DATA 000000
1530 DATA 000001  1860 DATA 111111  2190 DATA 000011  2520 DATA 110000  2850 DATA 000000
1540 DATA 000011  1870 DATA 111111  2200 DATA 000011  2530 DATA 000000  2860 DATA 000000
1550 DATA 000011  1880 DATA 111111  2210 DATA 000011  2540 DATA 000000  2870 DATA 000000
1560 DATA 000011  1890 DATA 011111  2220 DATA 000011  2550 DATA 000000  2880 DATA 000000
1570 DATA 000001  1900 DATA 000000  2230 DATA 000111  2560 DATA 000000  2890 DATA 000000
1580 DATA 000010  1910 DATA 111100  2240 DATA 000111  2570 DATA 000000  2900 DATA 000000
1590 DATA 100111  1920 DATA 111100  2250 DATA 000111  2580 DATA 000000  2910 DATA 000000
1600 DATA 000111  1930 DATA 111110  2260 DATA 000011  2590 DATA 011111  2920 DATA 000000
1610 DATA 100000  1940 DATA 111111  2270 DATA 000001  2600 DATA 001111  2930 DATA 000000
```

Continued next week

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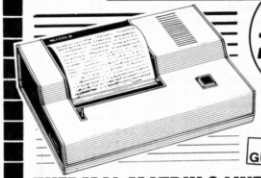

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PCNProgramCards

Asteroid Lander

8327AL4/7

Card 4 of 7

```
1730 LINE(0,0)-(255,191),PRESET,B
1740 DRAW"S4:BM0,10:"+V$+"BM+1,+0"+E$+L$
+O$+"BM+2,+0"+C$+I$+T$+Y$
1750 LINE(60,5)-(222,8),PSET,B
1760 LINE(60,5)-(62+S*4,8),PSET,B
1770 DRAW"S8:BM237,13:"
1780 IF LIVES=1 THEN DRAW L1$
1790 IF LIVES=2 THEN DRAW L2$
1800 IF LIVES=3 THEN DRAW L3$
1810 PLAY"T255:V20:O5:ACACACACACACACAC
AC"
1820 FOR J=1 TO 400:NEXT J
1830 REM START TIMER AND GAME
1840 TIMER=TI
1850 SCREEN1,1
1880 REM PLACE ROCKET ON SCREEN
1890 PUT(X,Y)-(X+8,Y+14),R,PSET
1900 IF THR<>0 THEN PUT(X,Y+14)-(X+8,Y+2
0),RR,PSET
1910 IF THR<>0 THEN PLAY"T255:V20:O1:AAA
A"
1920 LINE(61,6)-(61+((S-THR)*4),7),PSET,
BF
1930 PUT(PP,161)-(PP+20,176),PAD,PSET
1940 REM DECIDE IF ROCKET HAS LANDED
1950 IF Y>145 AND X>PP-3 AND X<PP+15 THE
N 2150
1960 REM DECIDE IF ROCKET HAS CRASHED
1970 IF Y>145 THEN 2470
1980 REM ERASE ROCKET
1990 PUT(X,Y)-(X+8,Y+20),NR,PSET
2000 REM MONITOR JOYSTICK & MAKE ADJUSTM
ENTS
2010 IF JCH=1 THEN 2020
2011 IF JOYSTK(0)<32 THEN X=X-S
2015 IF JOYSTK(0)>32 THEN X=X+S
2016 GOTO 2030
2020 IF PEEK(343)=223 THEN X=X-S
2025 IF PEEK(344)=223 THEN X=X+S
2030 W=PEEK (65280)
2035 IF PEEK(342)=223 THEN W=126 ELSE W=
127
2040 IF W=126 OR W=254 THEN THR=THR+1
2050 IF W=127 OR W=255 THEN THR=0
2060 IF THR>S THEN THR=S
2070 Y=Y+S-THR
2080 IF X>245 THEN X=245
2090 IF X<4 THEN X=4
2100 LINE(61,6)-(61+S*4,7),PRESET,BF
2110 REM LOOP BACK TO PLACE ROCKET IN NE
W POSITION
2120 GOTO 1890
2130 REM LANDED ROUTINE
2140 REM STOP TIMER
2150 TI=TIMER
2160 REM RE-DRAW ROCKET & PAD
2170 PUT(X,Y)-(X+8,Y+20),NR,PSET
2180 PUT(PP,161)-(PP+20,176),PAD,PSET
```

1730-1820	Finish screen and variable set-up
1830-1840	Start timer and game
1890-1930	Place rocket on screen
1950	Check for rocket having landed
1970	Check for rocket crash
1990	Erase rocket
2010	Choose between joysticks or keyboard
2011-2016	Monitor joystick and make adjustments
2020-2025	Monitor keyboard and make adjustments
2040-2060	Monitor thrust
2120	Replace rocket and continue
2140-2150	Stop timer
2160-2180	Redraw rocket and pad

PCNProgramCards

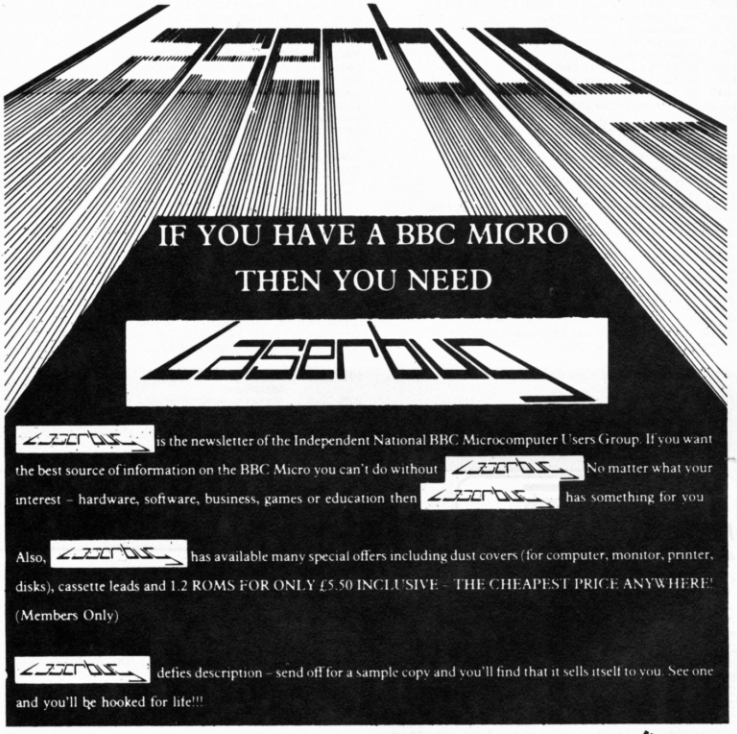
Asteroid Lander

8327AL5/7

Card 5 of 7

```
2190 PUT(X,146)-(X+8,160),R,PSET
2200 REM DRAW 'LANDED'
2210 LINE(60,60)-(202,92),PRESET,BF
2220 DRAW"S16:BM55,90:"+L$+A$+N$+D$+E$+D
$
2230 POKE&HFFD6,0
2240 PLAY"T12:O4:V31:AABBCCDDEEFFGGFFEED
DCCBBAA"
2250 REM ENLARGE ROCKET
2260 PMODE2,3:SCREEN 1,1
2270 LINE(20,30)-(232,78),PRESET,BF
2280 DRAW"S24:BM13,75:"+L$+A$+N$+D$+E$+D
$
2290 PLAY"O1:V31:AABBCCDDEEFFGGFFEEDDCCB
BAA"
2300 FOR J=1 TO 1000:NEXT J
2310 REM ALTER VARIABLES & PRINT LANDED
PAGE
2320 B=B+1
2330 S=S+V
2340 IF S>40 THEN S=40
2350 CLS RND(9)-1
2360 PRINT@77,"landed";
2370 POKE1099,42:POKE1100,42:POKE1107,42
:POKE1108,42
2380 PRINT@161,"YOUR MAXIMUM VELOCITY NO
W=";S;
2390 PRINT@258,"YOU HAVE ACHIEVED";B;"LA
NDING":IF B<>1 THEN PRINT"S";
2400 PRINT@356,"YOUR TIME IS";FIX(TI/50)
;"SECOND":IF FIX(TI/50)<>1 THEN PRINT"S
";
2410 PRINT@453,"AND YOUR SCORE IS";FIX(B
*300000/TI)+B*100;
2420 SCREEN 0,1
2430 REM LOOP BACK TO SET UP GAME SCREEN
 & START GAME
2440 GOTO1610
2450 REM CRASHED ROUTINE
2460 REM STOP TIMER
2470 TI=TIMER
2480 REM PLACE ROCKET ON PLANET IF NOT A
LREADY THERE
2490 IF Y>160 THEN 2540
2500 PUT(X,Y)-(X+8,Y+20),NR,PSET
2510 Y=160
2520 PUT(X,Y)-(X+8,Y+14),R,PSET
2530 REM DRAW 'CRASHED'
2540 LINE(43,60)-(209,92),PRESET,BF
2550 DRAW"S16:BM42,90:"+C$+R$+A$+S$+H$+E
$+D$
2560 POKE&HFFD6,0
2570 REM EXPLOSION
2580 FOR EX=1 TO 4
2590 PMODE3:SCREEN1,1
2600 PLAY"T255:V31:O1:EFGEFGEFG"
2610 SCREEN1,0
2620 FOR J=1 TO 5
```

2190	Complete drawing of rocket
2200-2240	Draw landed rocket
2250-2300	Enlarge rocket
2310-2420	Alter variables and print landed page
2440	Restart game
2450	Crashed routine
2480-2520	Put rocket on planet
2530-2560	Draw crashed rocket
2570-2620	Start of explosion routine



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PCN ProgramCards

Asteroid Lander

8327AL6/7

Card 6 of 7

```
2630 PUT(X,Y)-(X+8+EX,Y+14+EX),R,PSET
2640 PUT(X-EX,Y-EX)-(X+8,Y+14),R,PSET
2650 PUT(X,Y+7)-(X+8+EX,Y+14+EX),R,OR
2660 PUT(X-EX,Y+7-EX)-(X+8,Y+14),R,OR
2670 NEXT J
2680 NEXT EX
2690 PMODE4:SCREEN1,1
2700 FOR J=1 TO 2000:NEXT J
2710 LIVES=LIVES-1
2720 IF LIVES<>0 THEN CLS RND(9)-1:PRINT
@76,"crashed":POKE1098,42:POKE1099,42:P
OKE1107,42:POKE1108,42:PRINT@163,"YOUR M
AXIMUM VELOCITY =";S;:GOTO 2390
2730 REM WORK OUT SCORES ETC. & PRINT SC
ORE PAGE
2740 MINS=FIX(TI/50/60)
2750 SECS=FIX((TI/50/60-MINS)*60)
2760 CLS RND(9)-1
2770 PRINT@124,"    ";
2780 PRINT@96,"YOU LASTED";MINS;"MINUTE"
;:IF MINS<>1 THEN PRINT"S";
2790 PRINT SECS;"SECOND";:IF SECS<>1 THE
N PRINT"S"
2800 PRINT@228,"YOU MADE"B"SAFE LANDING"
;:IF B<>1 THEN PRINT"S";
2810 YS=FIX(B*300000/TI)+B*100
2820 PRINT@357,"AND YOUR SCORE IS";YS;
2830 SCREEN 0,1
2840 FOR J=1 TO 3000:NEXT J
2850 PRINT@450,"PRESS ANY KEY FOR ANOTHE
R GO";
2860 IF INKEY$="" THEN 2860
2870 REM LOOP TO HIGH SCORE ROUTINE IF S
CORE IS NEW HIGH SCORE
2880 IF YS>HS THEN HS=YS:GOSUB 2940
2890 REM LOOP TO HIGH SCORE PAGE
2900 GOSUB 3270
2910 REM LOOP BACK TO START BRAND NEW GA
ME
2920 GOTO 1170
2930 REM INPUT HIGH SCORE ROUTINE
2940 CLS
2950 FOR J=1 TO 5
2960 PRINT@73,"YOU'VE GOT THE"
2970 PRINT@160,"**********high*score***
********"
2980 PRINT@192,STRING$(64,"*")
2990 GOSUB 3110
3000 PRINT@160,STRING$(32,"*")
3010 PRINT@192,"**********high*score***
********"
3020 PRINT@224,STRING$(32,"*")
3030 GOSUB 3110
3040 PRINT@192,STRING$(32,"*")
3050 PRINT@224,"**********high*score***
********"
3060 GOSUB 3110
3070 PRINT@192,"**********high*score***
********"
```

2630-2680	End of explosion routine
2730-2850	Calculate the score and print score page
2880	Check for new high score
2930	Get new high score

PCN ProgramCards

Asteroid Lander

8327AL7/7

Card 7 of 7

```
3080 PRINT@224,STRING$(32,"*")
3090 NEXT J
3100 GOSUB 3150
3110 SCREEN 0,1
3120 PLAY"V20:T200:O3:CDEGCDEGCDEG"
3130 RETURN
3140 PRINT@320,STRING$(32,CHR$(32));
3150 PRINT@324,"PLEASE TYPE IN YOUR NAME
"
3160 PRINT:PRINT
3170 LINE INPUT HS$
3180 IF LEN (HS$)>32 THEN PRINT@324,"SOR
RY'32'LETTERS MAXIMUM":PLAY"T225:V31:O5:
ABCABCABC":PRINT@418,STRING$(93," "):GOT
O 3150
3190 PRINT@320,STRING$(96,CHR$(32));
3200 PRINT@323,"IS THIS CORRECT? (Y/N) "
;
3210 INPUT CO$
3220 IF CO$="Y" OR CO$="YES" OR CO$="N"
OR CO$="NO" THEN 3230 ELSE 3190
3230 IF CO$="N" OR CO$="NO" THEN PRINT@4
16,STRING$(32," ")
3240 IF CO$="N" OR CO$="NO" THEN 3140 EL
SE RETURN
3250 RETURN
3260 REM PRINT HIGH SCORE PAGE
3270 CLS RND(9)-1
3280 PRINT@46,"the";
3290 PRINT@104,"asteroid lander";
3300 PRINT@171,"high score";
3310 PRINT@239,"is";
3320 PRINT@300,"held by";
3330 POKE1069,42:POKE1073,42:POKE1127,42
:POKE1136,42:POKE1143,42:POKE1194,42:POK
E1199,42:POKE1205,42:POKE1262,42:POKE126
5,42:POKE1323,42:POKE1328,42:POKE1331,42
3340 PRINT@226,HS;
3350 PRINT@248,HS;
3360 PC=384+((32-LEN(HS$))/2)
3370 PRINT@PC,HS$;
3380 RC=RND(127)+127
3390 PRINT@PC+32,STRING$(LEN(HS$),CHR$(R
C));
3400 PRINT@PC-32,STRING$(LEN(HS$),CHR$(R
C));
3410 PLAY"V5:T50:O5:AGAGAG"
3420 IF INKEY$<>"" THEN RETURN  ELSE 338
0
3430 END
```

3150-3250	Get high scorer's name
3260-3420	High score page

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"YOU ASK WE SUPPLY"

Clubnet keeps you in touch with micro enthusiasts throughout the UK. It is divided into clubs and user groups and a list of each is published on alternate weeks.

This week it is the turn of user groups, which are listed alphabetically by machine and special interest.

If your association has something special on the agenda or if you're starting a new one, contact us at *Clubnet, Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HG.

The listings are based on that of the Association of Computer Clubs.

Our Clubnet Report this week focuses on the North Hampshire branch of ICPUG.

Portable on show

The North Hampshire Independent Commodore Products User Group tries to arrange its monthly meetings to serve a specific purpose, and on the evening *PCN* paid the group a visit John Collins, a consultant to Commodore, came to demonstrate the SX64, a portable which should be available by the end of the year.

The group attracts about 15 to 20 people each month to its meetings in Farnborough, half of them children aged between 12 and 16.

It was set up by organiser Ron Geere five years ago and now meets every month at the home of Graham Hunt, one of the 35 members.

Programming clinics have proved popular, accounting for about half of this year's meetings, and ideas for the future include a demonstration of a data capture device.

The main problem the group faces is that of premises. It used to meet in a school — one of its members was a schoolteacher — but this stopped when he left teaching. Rented rooms were tried, but this led to a drop in membership and the group was suspended for a while. It was restarted in its present form last January.

Another of the group's organisers, Roger Chesell, an army officer who is taking a Higher National Certificate in computer science, said: 'We are actively looking for premises, preferably free!'

He added: 'There is a 30p charge at the moment which covers the costs of tea and coffee and the newsletter we try to put out every month before the meetings.'

Mr Chesell summed up the spirit of the club as catering for all — young and old, experienced or amateur. **Janice McKenzie**

Programming clinics have been popular.

Name Independent Commodore Products User Group, North Hampshire Branch **Venue** 70 Reading Road, Farnborough, Hants **Meetings** Third Wednesday every month **Contact** Ron Geere, 109 York Road, Farnborough, Hants.

USER GROUPS

Acorn

Coventry Acorn Atom User Group. Peter Frost, 18 Frankwell Drive, Coventry, 0203 613156.

Kent Medway Acorn User Group. Meets at St John Fisher School on last Monday of month at 7pm. Sessions at 9pm Thursday at the Fox and Hound, Chatham. Clem Rutter, c/o St John's Fisher School, Ordance Street, Chatham, Kent, 0634 42811 (day), 0634 373459 (evenings).

Manchester Acorn User Group. Meets at AMC, Crescent Road, Crupsall, Manchester 8 on Tuesday except school holidays. John Ashurst, 192 Vendure Close, Failsworth, Manchester, 061-681 4962.

Apple

Ashtead Appler User Group. Meets first Monday of every month. Contact M Lawrence, 15 Petters Road, Ashtead, Surrey.

British Apple Systems User Group, PO Box 174, Watford WD2 6NF.

British Apple Systems User Group. Meets first Tuesday evening and third Sunday afternoon every month at Old School, Branch Road, Park Street, St Albans. Subs: £12.50 + £2.50 joining. Contact D Bolton, 0727 72917.

Birmingham & Region Apple Group. Contact Mel Golder, 021-426 2275.

Bristol Apple Users and Dabbiers. Meets at 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, once a month. Ewa Dabkowski, c/o Datalink, 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, 0272 213427.

Buckinghamshire Apple User Group. Steve Profitt, The Granary, Hill Farm Road, Marlow Bottom, Buckinghamshire, 062 84 73074.

Chelmsford Apple Users Club. Proposed new club. Contact D Beckingham, 571 Galleywood Road, Chelmsford, tel: Chelmsford 66948.

Croydon Apple User Group. Meets at Sidda House, 350 Lower Addiscombe Road, Croydon, on second Monday of month. Paul Vernon, 60 Flawkhurst Way, West Wickham, Kent, 01-777 5478.

London Apple Music Synthesis Group. Dr Davis Ellis, 22 Lennox Gardens, London SW1.

South-East London Apple User Group (Appletree). Contact John Grieve at 106 Maran Way, Erith, Kent or phone 01-311 7681.

Milton Keynes Microcomputer User Group. Meets every Tuesday, 7.30pm. Brian Pain, Sir Frank Markham School, Woughton Centre, Chaffron Way, Milton Keynes.

Atari

Birmingham User Group. Meets at the Malaga Grill, Matador Public House, Bull Ring shopping centre, Birmingham, on second and fourth Thursday every month at 7.30pm. Mike Aston, 42 Short Street, Wednesbury, West Midlands.

Carshalton Atari User Club. Paul Deegan, 01-642 5232.

South Cheshire Atari User Group. Meets at the Earl of Crewe, Nantwich Road, Crewe, on first Thursday of each month at 7.30pm. Contact A Davies, 48 Blagg Lane, Nantwich, Cheshire, 0270 626969.

Essex. Contact John Sarrar, 138 Frederick Road, Rainham, Essex, tel (76) 22077. Meets at Rainham Town Football Club, 7.30pm, second and fourth Friday of each month.

Hull Atari Users Local Group. Harvey Kong Til, 546 Holderness Road, Hull HU9 3ES. Hull 7911094.

London Silica Atari 400/800 User Club. Richard Hawes, 01-301 1111.

Manchester Atari Computer Enthusiasts. Meets at The Ellesmere, Worsley Road, Worsley, on the second and last Thursday of every month. Contact Martin Davies, Bolton 700757.

South Middlesex Atari Club. Meets fortnightly, Tuesdays, at Staines Methodist Church Hall, Kingston Road, Staines. Contact Brian Milligan, 50 Linkscroft Avenue, Middelesex. Tel: Ashford (69) 45387.

Norwich Atari User Group. Ken Ward, Norwich 661149.

Preston Atari Computer Enthusiasts. Meets at KSC Club, Merrion House, Beach Grove, Ashton, Preston, on third Thursday of month at 7.30pm. Roger Taylor, 0253 738192.

UK Atari Computer Owners Club. Contact PO Box 3, Raleigh, Essex.

Atom

Liverpool BBC and Atom User Group. Meets at Old Swan Technical College. Room C33 on first Wednesday of month at 7.30pm and at Birkenhead Technical College on third Thursday of month at 7.30pm. Nick Kelly, 051-525 2934 (evenings).

BBC

Laserbug is an international user group for the BBC micro. Paul Barbour, 10 Dawley Ride, Colnbrook, Slough, Berks, 02812 30614.

Beebug. Sheridan Williams or David Graham at PO Box 50, St Albans, Hertfordshire AL1 2AR.

Bournemouth BBC User Group. Meets at Lansdowne Computer Centre, 5 Holdenhurst Road, Bournemouth on first and fourth Wednesday of month at 7.30pm. Norman Carey, 0202 749612.

Brent/Barnet User Group. Meets on last Sunday of month. Joseph Fox, 4 Harman Close, London NW2 2EA.

Charlton & District (South Manchester) BBC Micro User Group. Contact Philip Harrison, 34 Holwood Drive, Manchester M16 8WS.

Chelmbug. Contact Ian on Chelmsford 69174.

Cardiff BBC Microcomputer Club. Meets alternate Wednesdays at Applied Science Lecture Theatre, University College, Newport Road, Cardiff.

Format 40/80 Club (BBC Disk User Group). Send SAE to Peter Hughes, Five Marsh Street, Bristol BS1 4AA.

Liverpool BBC & Atom Group. Meets on the first Wednesday of every month at Old Swan Technical College, Room C33, 7.30-9.30pm, and on the third Thursday at Birkenhead Tech. College, 7.30-9.30pm. Contact Nik Kelly, 56 Queens Drive, Walton, Liverpool L4 6SH.

North London BBC Micro Users Group. Meets at The Prince of Wales, 37 Fortune Green Road, on Tuesdays at 7pm. Dr Leo McLaughlin, Westfield College, University of London, Kidderpore Avenue, London NW3 7ST, 01-435 0109.

Norwich & District BBC Microcomputer User Group. Meets at Norwich City College on the first and third Tuesday of every month at 7pm. Subs: £3; students and OAPs £1.50. Contact Paul Beverley, Department of Electronics, Norwich City College, Ipswich Road, Norwich NR2 2LJ.

Preston area BBC Micro User Group. Meets at Boatmans Arms, Marsh Lane, Preston, on last Thursday of month. Duncan Coulter, 8 Briar Grove, Ingol, Preston, Lancashire, 0772 725793.

Tyne & Wear BBC User Club. Contact Ian Waugh, 13 Briardene Drive, Wardley, Tyne & Wear NE10 8AN.

Wakefield BBC Micro User Group. Meets at Holmfield House, Clarence Park, Wakefield, on first Wednesday of each month at 7.30pm. Contact R Bilton tel: Wakefield 382274.

Wellingborough BBC Owners User Group. Contact R Houghton, 49 Addington Road, Irthlingborough.

Witham (NAMEBUG) BBC Micro User Group. Meets at comprehensive school, Witham on second Thursday each month at 7.30pm. Dave Watts 0245 358127 after 7pm.

Basic

Welwyn Basic User Group meets at Campus West Library, Welwyn Garden City, Herts, on last Friday of each month at 7pm. Contact Debi Colthorpe, 36 Birds Close, Welwyn Garden City, Herts, 96 30082.

Comal

London Comal User Group. Meets at Polytechnic of North London, Holloway, second Wednesday of month, term time. John Collins, 75 74111.

Commodore ICPUG

Basildon. Contact Walter Green, 151 The Hatherley, Basildon, Essex.

Bloxham. Contact John Temple, Kirabanda, Rose Bank, Bloxham, Oxon.

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Barnsley. Bob Wool, 13 Ward Green, Barnsley, South Yorkshire. 0226 85084.
Blackpool. Meets at Arnold School, Blackpool, on third Thursday of month. David Jarrett, 197 Victoria Road, Thornton Cleveleys, Blackpool FY5 3ST.
Birmingham. Contact J A McKain, PPI Ltd, 177 Lozells Road, Birmingham, tel: 021-544 0202.
Bournemouth & Poole. Contact Douglas Shave, 97 Canford Cliffs Road, Poole, Dorset BH13 7EP.
Bury St Edmunds. Contact Alan Morris, 30 Kelso Road, Bury St Edmunds, Suffolk.
Burnley. Contact John Ingham, 72 Ardwick Street, Burnley, Lancashire.
Canterbury SE. Meets at The Physics Lab, Canterbury University, on first Tuesday and Wednesday of month. R Moseley, Rosemount, Romney Hill, Maidstone, 0622 37643.
Carrickfergus. David Bolton, 19 Carrickburn Road, Carrickfergus, Antrim BT38 7ND, 09603 63788.
Chelmsford. Contact A G Surridge, 97 Shelley Road, Chelmsford, Essex.
Cheltenham. Meets at the Cheltenham Ladies College on last Thursday of month at 7.30pm. Alison Schofield, 78 Hesters Way Road, Cheltenham, Gloucester, 0242 580789.
Clwyd. John Poole, 6 Ridgway Close, Connah's Quay, Clwyd CH5 4LZ.
Corby. Peter Ashby, 215 Wincohn Way, Corby, Northamptonshire, 05363 4442.
Coventry. Meets at Stoke Park School and County College at 7pm on fourth Wednesday of month except July, August, December. Will Light, 22 Ivybridge Road, Stryechale, Coventry, Warwickshire.
Derby. Meets at Derby Professional Colour every other Tuesday at 7pm. Robert Watts, 03322 72569.
Derbyshire & District. Meets every other Monday 7-9pm at Davidson Richards Ltd, 14 Duffiied Road, Derby. Contact Raymond Davies, 105 Normanton Road, Derby DE1 2GG.
Devon. Contact Matthew Stibbe, The Lawn, Lower Woodfield Road, Torquay, Devon.
Durham. North-East Pet and UCPUG. Meets at Lawson School, Burnley at 7pm second and third Mondays. Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham, 0385 67045.
Dyfed. Simon Kniveton, 097 086 303.
Gosport. Meets at Bury House, Bury Road, Gosport, Hants at 7pm. Contact Tony Cox, 10 Staplers Reach, Rowner, Gosport, Hants.
Hainault. Meets at Grange Remedial Centre, Woodman Path, Hainault. Carol Taylor, 101 Courtlands Avenue, Cranbrook, Ilford, Essex.
Glasgow. Dr Jim MacBrayne, 27 Daidmyre Crescent, Newton Mearns. Glasgow, 041-639 5696.
Gloucester and Bristol Area. Meets last Friday of each month. Contact Janet Rich, 20 Old Court, Spring Hill, Cam, Gloucester.
Hampshire. Meets at 70 Reading Road, Farnborough, on third Wednesday of month. Ron Geere, 109 York Road, Farnborough, Hants, 0252 542921.
Gosport. Contact Brian Cox, Bury House, Bury Road, Gosport, Hants, Fairham 280539.
Hants. Contact Tony Cooke, 7 Russell Way, Petersfield, Hampshire GU31 4LD.
Hertfordshire North. Meets at Provident Mutual Assurance, Purwell Lane, Hitchin, on last Wednesday of month. B Grainger, 73 Minehead Way, Stevenage, Herts SG1 2HS, 0438 727925.
Kilmarnock. Meets at Symington Primary School on first and third Thursday of month at 7pm. John Smith, 19 Brewlands Road, Symington, Kilmarnock KA1 5RW, 0563 830407.
Liverpool. Meets at The Merchant Taylor School for Boys, Crosby, on second Thursday of month at 7pm. Tony Bond, 27 Ince Road, Liverpool L23 4UE, 051-924 1505.
Llandyssul. Contact F Townsend, The Hill, Rhydowen, Llandyssul, 05455 5291.
London. Alan Birks, 135 Queen Alexandra Mansions, Judd Street, London WC1, 01-430 8025.
London North. Barry Miles, Department of Business Studies, North London Polytechnic, Holloway Road, London N7, 01-607 2789.
Maidstone. Meets on the first Wednesday of every month contact Ron Moseley, Lord Romney Hill, Weavering Maidstone, Kent, 0622 37643.
Manchester. Contact Clive Embrey, 17 Santon Avenue, Fallow Field, Manchester.
Mapperley. Meets at Arnold & Carlton College, Digby Avenue, Mapperley every Friday. Contact Mark Graves, 8 Digby Hall Drive, Gunthorpe Road, Gedling, Notts NG4 4JT.
Merseyside. Meets fortnightly. Contact P Leather, 27 St Luke's Drive, Formby, Merseyside, tel: 36 74694.
National. Contact Membership Secretary, 30 Brancoates Road, Newbury Park, Ilford, Essex 1G23 7EP.
Norfolk. Proposed new club. Contact J Blair, 7 Beach Road, Cromer, Norfolk.
Norfolk. Peter Petts, Bramley Hale, Wretton, King's Lynn, Norfolk PE33 9QS, 0366 500692.
Northampton. Contact Peter Ashby, 215 Lincoln Way, Corby, Northants.
Northern Ireland. Meets last Wednesday of each month. Contact David Weddell, 9 Upper Cavehill Road, Belfast BT15 5EZ, 0232-711580.
Northumberland. Graham Saunders, 22 Front Street, Guide Post, Northumberland.
Rhyl. Contact Frank Jones, 77 Millbank Road, Rhyl, Clywd, 0745 54820.
Slough. Meets at Slough College on second Thursday of month at 7.30pm. Brian Jones, 53 Beechwood Avenue, Woodley, Reading RG5 3DF, 0734 661494.
South-East. Regional Group. Meets at Charles Darwin School, Jail Lane, Biggin Hill, Kent, on third and fourth Thursday of month at 7.30pm. Jack Cohen, 30 Brancaster Road, Newbury Park, Ilford, Essex, 01-597 1229.
South Midlands. Meets at 12 York Street, Stourport-on-Severn on last Thursday of month. M J Merriman at above address.
Staffordshire. 57 Clough Hall Road, Kidsgrove, Stoke-on-Trent.
Stourport-on-Severn. Meets last Thursday of each month. Contact M Merriman, 12 York Street, Stourport.
Teddington. G Squibb, 108 Teddington Park Road, Teddington, Middlesex, 01-977 2346.
Watford. Meets on second Monday of month. Stephen Rabagtiati, c/o Institute of Grocery Dist. Grange Lane, Letchmore Heath, Watford, Herts, 01-779 7141. **Witney.** Contact Ian Blyth, 40 Wilmot Close, Witney 5171.
Wolverhampton. Meets monthly. Contact J Bowman, 6 The Oval, Albrighton, Wolverhampton, West Midlands.

Commodore Pet

Blackpool. West Lancashire Pet Users Club. Meets at Arnold School, Blackpool on the third Thursday of month. D Jowett, 197 Victoria Road, East Thornton, Blackpool FY5 3ST.
Southern Users of Pets Association. Howard Pilgrim, 42 Compton Road, Brighton BN1 5AN.
Pet User Group Crawley. Richard Dyer, 33 Parham Road, Ifield, Crawley.
Pet Users Education Group. Dr Chris Smith, Department of Physiology, Queen Elizabeth College, Camden Hill Road, London W8 7AH.
UK Pet Users Club. 360 Euston Road, London NW1 3BL.
Pet Users Group. Meets at Polytechnic of North London, Eden Grove, Room 320. On alternate Tuesdays, 6pm. Barry Miles 01-607 2789.
Pet User Club. Margaret Gulliford, 818 Leigh Road, Slough Industrial Estate, 0753 74111.
Independent Pet Users Group. 57 Clough Hall Road, Kielsgrove, Stoke-on-Trent, Staffordshire.

Commodore Vic

National Association of Vic-20 Owners. Contact S Tomananek, 20 Milner Road, Sherwood, Nottingham.
Burnley. John Ingham, 72 Ardwick Street, Burnley, Lancashire.
Clwyd. Contact A Stanners, 192A Willow Park, Queensferry, Deeside, Clwyd, Wales, 816603.
London. Vic Users Group. Meets on alternate Tuesdays at 6.30pm at Polytechnic of North London, Community Centre. Robin Bradbeer.
London. Contact Jim Chambers, Department of Psychology, University College London, Gower Street, London, WC1, 01-387 7050 x 413. Meets at University College, 26 Bedford Way, London WC1, third Tuesday of each month at 8pm.
Norfolk. J Blair, 7 Beach Road, Cromer, Norfolk, 0263 512849.

Compucolour

Caversham. Compucolour Users Group UK. Meets at Community Centre, Caversham Park Village twice a year. Peter Hiner, 11 Pennycroft, Harpenden, Hertfordshire, 05827 64872.

CP/M

Irish CP/M Users Group. Meets monthly in Dublin area. Doug Notley, Gardner House, Ballsbridge, Dublin 4, Dublin 686411.
London. CP/M User Group (UK). Subs £7.50. Produces newsletter. Contact David Powys-Lybbe, 01-247 0691.
UK CP/M Users Group. Lesley Spicer, 11 Sun Street, London EC2M 2QD, 01-247 0691.

COSMAC

COSMAC Users Group. James Cunningham, 7 Harrowden Court, Harrowden Road, Luton, Bedfordshire, 0582 423934.

Decus

Decus UK & Ireland. Contact Tracey Pardoe, DECUS, PO Box 53. Reading, Berks RG2 0TW.

Digital Equipment

Digital Equipment Users Society. The Secretary, PO Box 53, Reading, Berkshire, 0734 387725.

Dragon

Brixham Dragon Owners Club. Meets at Computer Systems (Torbay), Pump Street, Brixham, every Saturday at 2.30pm. Ian Chipperfield, 22 Brookdale Court, Brixham, Devon, Brixham 59224.

Epson HX20

London. Contact Terence Ronson, 25 Sawyers Lawn, Drayton Bridge Road, Ealing, W13, 01-998 1494.
Greater Manchester. Contact Melvin Franklin, 40 Cowlees, Westhoughton, Bolton, Lancs.
Luton. The Dragon's Den. Contact D Buckingham, 83 Neville Road, Limbury, Luton, Beds.

Education

Birmingham. Education ZX80/81 User Group. Eric Deeson, Highgate School, Balsall Heath Road, Highgate, Birmingham B12 9DS.
Birmingham. MUSE. National body for co-ordinating activity in schools, colleges. Lorraine Boyce, MUSE Information Office, Westhill College, Weoley Park Road, Birmingham, 021- 471 3723.
Dublin. Computer Education Society of Ireland. Dairmuid McCarthy, 7 St Kevins Park, Kilmacud, Blackrock, Co. Dublin.
Middlesex. Educational Users Group. Offshoot of National TRS-80 Users Group. Dave Fletcher, Head Teacher, Beaconsfield First and Middle School, Beaconsfield Road, Southall, Middlesex.
Worcestershire. Mini and Microcomputer Users in Education. National organisation. R Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire B61 0JT.

Forth

Forth Users Group. David Husband, 2 Gorleston Road, Branksome, Poole, Dorset BH12 1NW, 0202 764724.
Forth Interest Group UK. Meets at Room 408, South Bank Polytechnic London SE1 on the first Thursday of the month. Contact K Goldie-Morrison, Bradden Old Rectory, Towcester, Northants.

Forum

Forum 80 Users Group. Frederick Brown, 421 Endike Lane, Hull HU6 8AG.

FX-500P

FX-500-P Users Association. Max Francis, 38 Grymsdyke, Great Missenden, Buckinghamshire HP16 0LP.

Genealogists

Society of Genealogists Computer Interest Group. Anthony Camp, 01-373 7054.

Genie

Colour Genie User Group. Details of meetings/membership from Pat Doohan, secretary, Nottingham (0602) 278791.

Intel MDS

UK Intel MDS Users Group. Lewis Hard, c/o S.P.A.C.E., The Old Coach House, Court Row, Upton-on-Severn, Worcester WR8 0NS.

Ithaca Audio S100

Ithaca Audio S100 Users Group. Dave Weaver, 41 Dore Avenue, North Hykenham, Lincoln LN6 8LN.

Jupiter Ace

Jupiter Ace Users Group. John Noyce, Remsoft, 18 George Street, Brighton BN2 1RH.

Lynx

National Independent User-Group. Subs £9. Contact Robert Poat, 53 Kingswood Avenue, Sanderstead, South Croydon CR2 9DQ.

Mattel

Mattel Intellivision TV Game Group. Warrington 62215 after 4pm.

Medical

Durham. Primary Health Care Group. Dr Alastair Malcolm, British Computer Society, Cheveley Park Medical Centre, Belmont, Durham, 0385 64282.
London. Medical Micro Users Group. Medicom, 1-2 Hanover Street, London W1.
Middlesex. TRS-80 Medical and Laboratory Users. Dr Robinson, The Residency, Northwick Park Hospital, Harrow, Middlesex.

Micronet

Micronet Independent User Group. Contact George Foot, Prestel Mailbox No. 892852867.

Nascom

Berkshire. Nascom Thames Valley User Group. Meets at Frogmore Hotel, Windsor, on Thursday fortnightly, 8pm. Mike Rothery, 37 Eaton Wick Road, Eton Wick, Windsor, Berkshire, Windsor 56106.
Birmingham Nascom User Group. Meets at Davenports Social Club, Granville Street, Birmingham on the last Thursday of month, 8pm. Martin Sidebotham, 021-744 3093.

International Nascom Microcomputer Club. 80 Oakfield Corner, Sycamore Road, Amersham, Buckinghamshire HP6 5EQ.
Merseyside Nascom User Group. Meets at Mona Hotel, St James Street, Liverpool, on the first Wednesday of month, 7.30pm. Mr T Searle, 051-526 5256.

Newbrain

Wakefield Independent Newbrain User Group. Anthony Hodge, 15 St John's Court, Wakefield WF1 2RY.
Welwyn. Contact Angela Watkiss, 4 Ninnings Lane, Rabley Heath, Welwyn, Herts AL6 9TD.

Ohio

Ohio Scientific User Group. Tom Graves, 19a West End, Street, Somerset, 0458 45359.

Oric

Oric Owners Group. Paul Kaufman, 3 Club Mews, Ely, Cambridgeshire.
Kent. Contact Roger Pyatt, 23 Arundel Drive, Orpington, Kent with SAE or call 66 20281.

Osborne

British Osborne Owners Group. J Anglesea, Flat 19, Rowan House, Mitton Road, Handsworth, Birmingham B20 2JR.

OSI

OSI UK User Group. Richard Elen, 12 Bennerley Road, London SW11 6DS.

Pascal

Pascal User Group. Nick Hughes, PO Box 52, Pinner, Middlesex HA5 3FE.

PDP

Buckinghamshire. PDP8 User Group. Nigel Dunn, 21 Campion Road, Widmer End, High Wycombe, Buckinghamshire, 0494 714483.
Hertfordshire. PDP11 User Group. Pete Harris, 119 Carpenter Way, Potters Bar, Hertfordshire EN6 5QB, 0707 52091.

Pilot

UK Pilot User Group. Alec Wood, Wirral Grammar School for Boys, Cross Lane, Bebington, Wirral, Merseyside LG3 3AQ.

Prestel

ACC National Prestel Committee. Administrates Club Spot 800 (hobbyists on Prestel). Rupert Steele, St John's College, Oxford OX1 3JP.

Research Machines

Birmingham. Research Machines 380Z Peter Smith, Birmingham Educational Computing Centre, Camp Hill Teachers Centre, Stratford Road, Birmingham B11 1AR.
Leamington Spa. West Midland RML User Group. Spencer Instone, c/o 59 Avenue Road, Leamington Spa.
Newcastle. NERML 380Z User Group. Meets monthly at Micro-Electronics Education Centre of the Polytechnic Coach Lane Campus. Mr Hatfield or Mr Reed, Computer Unit, Northumberland Building, Newcastle Polytechnic, 0632 326002.
Oxford. Research Machines Ltd National User Group. Barry Mawer, 0704 24457.
West Midlands RML User Group. Contact 0926 38751.

Sharp MZ80

Aberdeen. International Sharp Users Group. Graham Knight, c/o Knights Computers, 108 Rossemount Place, Aberdeen, 0224 630526.
Essex. Sharp MZ80K User Group. Joe Street, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE.
Leeds. Sharp PC1211 Users Club. Jonathan Bakeyne, 281 Lidgett Lane, Leeds LS17 3AQ.
Somerset. Sharp MZ80 Users Club. Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset BA21 4AE.

Sinclair

Aylesbury. Sinclair ZX Computer Club. Ken Knight, 0296 5181.
Brighton. ZX Users Group. J Ireland-Hill Jnr, 145 Godwin Road, Hove, Brighton.
Colchester Sinclair User Group. Meets forthnightly. Richard Lawn, 102 Pettygate Road, Colchester, Essex.
Cardiff. ZX Club. Meets on last Sunday of month, 2pm. Mike Hayes, 54 Oakley Place, Grangetown, Cardiff, 0222 371732.
Doncaster & District Sinclair User Group meets at St Andrews Hall, Morley Road, Wheatley, Doncaster, every Wednesday except the first in each month. Contact John Woods, Doncaster 29357.
Edinburgh. ZX. Meets at Claremont Hotel, Claremont Crescent, Edinburgh, on second and fourth Wednesdays every month, 7.30pm. John Palmer, 56 Meadowfield Drive, Edinburgh, 031-661 3183.
Essex. Contact M Burnett, 24 Inverness Drive, Hainault, Ilford, Essex.
Glasgow. ZX80/81 User Group. Ian Watt, 10 Greenwood Road, Clarkston, Glasgow, 041-638 1241.
Liverpool. ZX Computer Club˙Meets at ZX Computer Centre, 17 Sweeting Street, Liverpool, on Wednesday, 6.30pm. Keith Archer, 051-260 4950.
London. National ZX User Club. Tim Hartnell, Interface, 44-48 Earls Court, London W8.
London. Sinclair User Group. Meets at Polytechnic of North London, Room 2-5 Tower Block. Monday, 6.30pm. Irving Brand, Polytechnic of North London, Holloway Road, London.
Manchester Sinclair Users Club. Meets at Longsight Library, 519 Stockport Road, Longsight, Manchester, every Wednesday at 7.30pm. Call 061-225 6997 or 061-445 6316.
ZX Spectrum Club. D Beattie, 63 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.
Scunthorpe. Grange Farm ZX Computer Club, Scunthorpe, South Humberside. Meets first and third Tuesday of month. Contact Sheila & Fred Wilkinson, 0724 842970.
Staffordshire. ZX80 National Software Association. 15 Woodlands Road, Wombourne, Staffordshire WV5 0JZ.
Suffolk. ZX Amateur Radio User Group. Paul Newsman, 3 Red House Lane, Leiston, Suffolk, SAE essential. No telephone inquiries.
Surrey. Guildford ZX80/81 Users Group. Meets Fridays. A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE, 0483 62035.
Surrey. ZX80/81 User Club. David Bigden, PO Box 159, Kingston-upon-Thames, Surrey KT2 5UQ.
West Sussex. Hassocks ZX Micro User Club. Paul King, 25 Fir Tree Way, Hassocks, West Sussex.

Sirius

Sirius User Group. Ray D'Arcy, Sirius User Club, The Microsystems Centre, Enterprise House, 7-71 Gordon Street, Luton, 0582 412215.

68XX

68XX Special Interest Group, meets third Tuesday of each month. Contact Jim Anderson, 01-422 4724.

6809 User Group

6809 User Group. Produce bi-monthly newsletter. Contact Mr Gibbons, Clarence Lodge, Hurdon Road, Launceston, Cornwall PL15 9DB.

Software

London. Software Group. Meets at Polytechnic of North London, Room 2-3 Tower block Thursday, 6pm. Mike Duck at Polytechnic of North London, Holloway, London N7.
Oxford. Program of the Month Club. Mr Durrant, 55 St Thomas Street, Oxford OX1 1JG, 0855 250333.

Sorcerer

Liverpool European Sorcerer Club. Monthly meetings. Colin Marle, 32 Watchyard Avenue, Formby, near Liverpool L37 3JU, 07048 72137.
Surrey. Exidy Sorcerer User Group. Andy Marshall, 44 Arthurs Bridge Road, Woking, Surrey GU21 4NT.

Spreadsheet

International Electronic Spreadsheet Users Group. UK Alpha House, 7th Floor, Rowlandsway, Manchester M22 5RG.

Tandy

Tandy Model 100 User Group. SAE to Remsoft, 18 George Street, Brighton, tel: 0273 602354.

Tangerine

Avon. Tangerine Users Group. Bob Green, 1 Marlborough Drive, Worle, Avon, 0934 21315.
Bristol. Tangerine Homebrew. A Coales, 35 Mogg Street, St Werburghs, Bristol BS2 9UB.

Texas Instruments

Brighton. Contact Clive & Audrey Scally, 40 Barrhill, Patcham, Brighton, Sussex.
Ireland. Proposed new club. Contact Mrs Ann Flynn, 53 Georgian Close, North Road, Drogheda, Co. Louth, Eire.
Leeds. TI99/4A User Group. Meets at 30 Gipton Wood Road, Leeds 8, Mondays 7pm. I Youlden, 0532 401408.
Manchester. TI User Group. T Grimshaw, 21 Allingham Street, Longsight, Manchester.
Manchester. TI9900 User Group. Chris Cadogan, Department of Computer Science, University of Manchester M13 9PL.

Triton

Triton User Group. Nigel Stride, Transam Ltd, 12 Chapel Street, London NW1, 01-402 8137.

TRS-80

Birmingham. National TRS-80 User Group. Meets at Adam & Eve Pub, 1st Floor, Bradford Street, Birmingham on last Friday of month. Michael Gibbons, 1 New Street, Castle Bromwich, Birmingham B38 9AP, 021-747 2260.
Chelmsford. TRS-80 User Group. Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.
Durham. North East TRS-80 User Group. Meets at Information Technology Centre, Gateshead on the third Wednesday of month, 7pm. J Dunn, 8 Ettrich Terrace, North Gateshead, County Durham.
Edinburgh. Scottish TRS-80 and Genie User Group. Meets at Mansion House Hotel, Milton Road, second Thursdays of month. Dick Mackie, 72 Morningside Drive, Edinburgh EH9 1DX, 031-447 6651.
Herts. Contact Reg Smith, 24 Sempill Road, Hemel Hempstead, Herts, 0442 60085.
Hull & District TRS-80/Beeb Users Group. Meets second Tuesday of month and Thursday 16 days later at Psychology Dpt, Hull University. Contact J Lawrence, 2a Hall Road, Hull HU6 8SA.
Isle of Wight. TRS-80 User Club. Meets at London Hotel, Ryde on last Friday of month. 7.30pm. Sean Coulson, 0903 614589.
Kent. TRS-80 User Group. Alan Reid, 22 Woodeys Road, Rainham, Kent, 0634 367012.
Greater Manchester. Northwest TRS-80 User Group. Meets at Barton Aero Club, Barton Aerodrome, Irlam, near Manchester on last Wednesday of month, 8pm. Melvin Franklin, 40 Cowlees, Westhoughton, Bolton, Lancs.
Lancs. TRS-80 Colour Computer Group. Subs: £3. Contact Ian Wild, 53 Darnton Road, Ashton-U-Lyne, Lancs OL6 6RL.
Liverpool. Merseyside TRS -80/Video Genie User Group. Meets second Thursday of month. 7.15pm. Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. 051-220 9733.
London, SW. TRS-80 User Group. Ron Everitt on 01-394 2123.
Merseyside. TRS-80 User Group. N Rushton, 123 Roughwood Drive, Northwood, Kirby, Merseyside.
Milton Keynes. National TRS-80 and Genie User Group. Brian Pain, 24 Oxford Street, Stony Stratford, Milton Keynes.
Nottingham. TRS-80 Genie Users Group. Meets at Wilford Moderns Rugby Club House on first and third Wednesday every month at 7.30pm. Contact Geoffrey Hillier, 5a Gregory Street, Lenton, Nottingham NG7 2LR, Nottingham 783938.
Nottingham. East Midlands TRS-80 User Group. Mike Costello, 15 Langbank Avenue, Rise Park, Nottingham NG5 5BU, 0602 751753.
London. TRS-80 Genie Group. Meets at Central Common Room, The Residency, Northwick Park Hospital on first Sunday of month. Dr Nick Robinson, Central Room, The Residency, Northwich Park Hospital.
Northants. TRS-80 User Group. Meets at Welwyn Park Community Centre on alternate Thursdays at 7pm. Neil Griffiths, 0858 65718.
West Herts 80 User Group. Meets at St Stephen's Parish Centre, Station Road, Bricket Wood, St Albans, Herts. Tuesday evenings fortnightly. Contact Reg Smith, 24 Sempill Road, Hemel Hempstead.

Colour Genie

International Colour Genie Users Group. Write with SAE to The Secretary, NCGUG, 46 Highbury Avenue, Bulwell, Nottingham, 0602 278791.
National Colour Genie User Group. Marc Leduc, 46 Highbury Avenue, Nottinghamshire NG6 9DB.

UCSD

Hants. UCSD System Users Society. John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG2 0QB.
Oxford. UCSD Pascal UK Users Group. Malcolm Harper, Oxford University Computing Laboratory Programming Research Group, 45 Banbury Road, Oxford OX2 6PE.

CUA

CUA User Group. Adrian Waters, 9 Moss Lane, Romford, Essex.

6502

Bedfordshire. 6502 User Group. Walter Wallenborn, 21 Argyll Avenue, Luton, Bedfordshire LU3 1EG, 0582 26927.
Hants. 6502 User Group (Southern Region). Steve Cole, 70 Sydney Road, Gosport, Hants.

Let us know about your micro club or user group so we can be sure the information printed here is up to date. Drop a card to Wendie Pearson, Listings Editor, at *Personal Computer News*, 62 Oxford Street, London W1A 2HG, or give her a call on 01-636 6890.

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Saturn 32K RAM Board	Requires VC-EXPAND series software
Saturn 128K RAM Board	Requires VC-EXPAND series software
Neptune 128K/80-col Apple //e	Requires VC-EXPAND series software
Neptune 192K/80-col Apple //e	Requires VC-EXPAND series software

SOFTWARE

EXPANDER	40-column Display with 2 × Ramex 16K Boards
SUPER EXPANDER	40-column Display with Ramex 128K Board
SUPER EXPANDER 80	80-column Display with Ramex 128K Board
SUPER EXPANDER 80.2	80-column Display with 2 × Ramex 128K Boards
VC-EXPAND	40-column Display with Saturn 128K and/or 32K Boards plus an optional Ramex 16K RAM Board
VC-EXPAND 80	80-column Display version of VC-EXPAND
VisiCalc PRE-BOOT Diskette	80-column Display with memory up to 64K
CDEX Training for VisiCalc	Inter-active self-training program
VisiCalc Utilities diskette	Improves presentation of printed reports
VisiCalc Formatting Aids	

HARDWARE

Videx ULTRATERM Board	**Software selectable display modes — 80-col × 24 PLUS:** 80x32, 80x48, 96x24, 128x32, 132x24, or 160x24
Videx VIDEOTERM Board	Provides standard 80-col × 24 lines display
Videx SWITCH PLATE	Manual switching 40/80-col for VIDEOTERM
Videx SOFT VIDEO SWITCH	Auto switching 40/80-col for VIDEOTERM
Videx ENHANCER][	Adds L/C characters, and Input Buffer to Keyboard
Videx FUNCTION STRIP	16 Function Keys programmable with ENHANCER][

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The Power of Multiplan	£10.95	VisiCalc for IBM Personal Computer	£15.40
The Power of 1-2-3	£10.95	VisiCalc Home & Office Companion	£11.50

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DATABASICS

This six-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE a microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (million cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS columns × lines The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price. **Tv** indicates that you can plug the computer into a television set (**M+**) indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOUR CAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy (**F**) or hard (**H**).

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£40	Nascom 3	£549	Globe 101	£1,850	Sharp PC3201	£2,300	Logica VTS Vitesse	£2,863	Panasonic JD800M	£3,795
Casio PB100	£50	Sharp MZ80A	£549	Genie III	£1,897	HP 85	£2,360	Decision-1 Computer O11	£2,869	Kemitron K3000	£3,795
TRS-80 PC4	£50	Commodore 4016	£632	Toshiba T-100	£1,900	HP Series 100, 120	£2,362	DMS Fox	£2,875	DEC PC 350	£3,850
Sharp PC1251	£80	Research Machine 480Z	£650	Sord M23	£1,932	Sord M23P	£2,369	Eagle III	£2,950	Vector 4	£3,852
Aquarius	£90	DAI PC	£684	Kayproll	£1,949	TI Prof. Computer	£2,386	Zenith Z89-81	£2,978	Sage II	£4,019
Casio FX702P	£90	Apple II	£776	Transtec BC2	£1,949	IBM PC	£2,392	Monroe EC 8800	£2,995	Sage IV	£4,190
Jupiter Ace	£90	Commodore 500	£799	Kenilworth 83G	£1,953	Xerox 820 Model II	£2,415	Philips P3500	£3,000	C-T010	£4,197
Sinclair Spectrum	£99	HP 75C	£883	Transam Truscan	£1,983	Haywood 3000	£2,439	Tanberg EC10	£3,000	Tandy TRS-80 Model 16	£4,199
Comx 35	£120	Sharp MZ80B	£900	Epson QX10	£1,995	LSI 44	£2,472	Archives 1	£3,003	Hytech H4500	£4,310
Tandy TRS-80 Pocket 2	£130	Apple IIe	£972	IDS Datamachine	£1,995	Canon CX-1	£2,500	Cromemco System 1	£3,025	BMC OK 11F800. Model 20	£4,360
Oric 1	£139.95	Commodore 8032	£1,129	Tandy TRS-80 Model II	£1,999	Adler Alphatronic P2U	£2,524	DECPC 325	£3,080	ADS 42	£4,500
Acorn Atom	£150	Commodore 710	£1,144	Kenilworth 83N	£2,012	IQ Tech Iona	£2,539	Direct 1000	£3,093	Televideo TS-80ZH	£4,533
Atari 400	£150	Microdecision	£1,144	Caltext Micro	£2,019	HP 87XM	£2,571	Equator	£3,099	Country Com'ters C1000	£4,542
Sord M5	£150	Fujitsu FM8	£1,150	LSI M3	£2,064	Quantum 2000	£2,587	Clenio Table-Tops 925	£3,105	Corvus Concept	£4,887
TI-99/4A	£150	Sanyo MBC 1000	£1,195	Haywood 9000 Composite	£2,064	Canon AS100	£2,633	ITT 3030	£3,105	ICL PC Model 31	£4,939
Colour Genie	£168	Pied Piper	£1,226	Hawk Model 110	£2,070	CP1100	£2,639	Monroe OC 8810	£3,162	Cromemco System 3	£5,170
Commodore VIC 20	£170	Positron 900	£1,259	Positron 9000	£2,134	Sord System 19	£2,600	HP Series 200 Model 16A	£3,211	Micro Five 1000	£5,175
Sharp PC1500	£170	Tandy TRS-80 Model III	£1,299	Research Machines 380Z	£2,147	Enterprise 1000	£2,645	Cifer Series 1	£3,214	Fortune 32:16 System 2	£5,204
Dragon 32	£200	Commodore 8096	£1,374	Superbrain JR	£2,150	Facit 6520	£2,645	Samurai	£3,214	Zeus 4	£5,400
Camputers Lynx	£225	Pascal 640	£1,437	Future Computers FX-20	£2,156	Olympia Boss Model A	£2,645	Torch	£3,214	Hawk Model 2110	£5,405
Tandy TRS-80 Colour	£240	NEC PC8000	£1,454	Comart Communicator	£2,180	Britannia Baby	£2,657	Sord M223	£3,277	Molecular M200	£5,462
New Brain A	£269	Signet 2	£1,483	Adler Alphatronic P2	£2,197	Adler Alphatronic P3	£2,696	Kontron RS180	£3,306	Altos 800/15	£5,663
Multitech MPS II	£269	Irvine Business Systems	£1,489	Country Com'ters C3000	£2,242	Eagle II	£2,702	Columbia PC 1600-1	£3,392	Durango F85	£5,744
BBC Micro Model A	£299	Televideo TS-800 Series	£1,495	Kemitron K2000E	£2,242	Almarc 801	£2,708	Digico Prince	£3,392	Triton 4	£5,744
Genie II	£299	HP 86A	£1,541	Rair Black Box 320S	£2,242	DEC Rainbow 100	£2,714	OEM Orion	£3,392	Marin Chip M9900	£5,750
Atari 800	£300	Osborne I	£1,581	Sanyo MBC 2000	£2,242	ICL PC Model 10	£2,754	Ajile	£3,400	SW Tech. Products S0/9	£5,750
Nascom 2	£327	Signet 10025	£1,599	Toshiba T-200	£2,242	Millbank SX10	£2,754	Barcellos AMT 100	£3,450	BASF 7100	£5,805
Genie I	£330	APL Signet	£1,610	TMK 332	£2,242	Olivetti M20D	£2,754	Kalamazoo 1050	£3,450	Compustar	£5,837
Commodore 64	£345	Zenith Z89-81	£1,668	Bonsai SM 3000	£2,294	Sirius I	£2,754	Cromemco System 2	£3,560	Sord M243	£5,842
Microtan 65	£389	Basis 108	£1,683	CALPC	£2,294	Victor 9000	£2,754	Digital Microsystems 3	£3,576	Archives IV	£5,905
BBC Micro Model B	£399	Commodore Spr. Pet 9000	£1,719	North Star Horizon	£2,294	North Star Advantage	£2,766	Decision-1 Computer 012	£3,674	Sage IV	£5,962
Datac Micro Controller	£431	Gemini Galaxy 2	£1,719	Sanyo MBC 1250	£2,294	Apple III	£2,780	Televideo TS 1602-C	£3,714	ICL PC Model 32	£6,037
Cortex	£454	British Micro Mini 803	£1,720	Casu Mini C2	£2,300	Sanyo MBC 4050	£2,817	Adds Multivision	£3,795	Rair Business Computer	£6,037
Epson HX20	£472	Microsolution Brit. Genius	£1,840	Seed System I	£2,300	Bonsai SM 4000	£2,842	Clenio Pronto	£3,795	Digital Microsystems 4	£6,210
										Superstar	£6,296
										Racal 6000	£6,327
										Eagle 1600	£6,497
										TI System 200-250	£6,695
										Compucorp 675	£6,780
										Wicat 150	£6,846
										Sundance I	£6,969
										Pascal Mod. Microengine	£7,003
										Diablo 3000	£7,250
										Onyx 5001 MU	£7,607
										Sundance II	£8,205
										Haywood Hinet	£9,550
										Altos 856-10	£9,631
										Apple Lisa	£9,775
										Micro Five 3000	£10,350
										Sundance 16	£10,480
										Spectrum	£11,442

ABBREVIATIONS

Ap: APL
As: Assembly
Ba: Basic
Co: Cobol
Cm: Comal
Fr: Forth
Fn: Fortran
Pa: Pascal

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Graphics: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Storage: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Acorn Atom	£150	6502	1	2K	40K	32×16	Tv(M+) ●		256×192	W							1	●		Cassette	BaAs	●	A1	Hobbyist micro
Adds Multivision	£3,795	8085A	5	64K	256K	80×25	M		640×240	W	28		1			1			1×350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80×24	M			W	6	●	2			1	3		2×160K5¼F	CP/M	Ba	●	T1	Good software choice
Adler Alphatronic P2U	£2,524	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×790K5¼F	CP/M		●	T1	16 bit option-promised
ADS 42	£4,500	8085A	4	32K		40×8	M		40×8	W		●	3				3	●	1×82K5¼F	Holland Automation	Ba		A3	Intelligent cash register
Ajile	£3,400	8088	4	256K		80×25	M		640×250	W	10	●	1	1	2		1		2×320K5¼F	MS-DOS	BaAs	●	A9	16-bit portable micro
Almarc 801	£2,708	Z80	4	64K	512K	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb
Aquarius	£90	Z80A	4	4K	52K	40×24	TV	●	320×192	C							1	●		Cassette	Ba		M7	Competition for Uncle Sir Clive
Altos 800/15	£5,663	Z80	4	192K	208K	80×24	M			W	8	●		1					1×450K5¼F	MP/M		●	L1	Multi user business machine
Altos 856-10	£9,631	8086	10	512K	1Mb	80×24	M			W	16	●	6						2×500K5¼F	Xenix	Xenix	●	L1	The 16-bit version
APL Signet	£1,610	Z80A	4	64K		80×25	Tv(M+)*	●		*			2						2×188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40×24	Tv(M+)	●	256×192	W							8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras
Apple IIe	£972	6502		64K	128K	80×24	M+	●		W					1		8			DOS	Ba	●	A8	Not an Apple II!
Apple III	£2,780	6502	2	128K	256K	80×24	(M+)	●	560×192	W		●	1				4		1×140K5¼F	SOS, DOS		●	A8	Will emulate Apple II
Apple Lisa	£9,775	68000	8	1Mb		120×30	M		792×360	W		●	2	1			3		2×860K5¼F	Lisa		●	A8	Learning time 30 mins
Archives I	£3,003	Z80	4	64K		80×25	M	●	240×100	W	23	●	2	1		1	5		2×386K5¼F	CP/M		●	S1	Standard CP/M + graphics
Archives IV	£5,905	Z80	4	512K		80×25	M	●	240×100	W	23	●	1			1	3		1×10Mb5¼H+1×7445¼F	CP/M, MP/M		●	S1	Hard disk version
Atari 400	£150	6502B	1.79	16K		40×24	Tv	●	320×192	T	3						7	●		Cassette	Ba	●	A5	Games computer, Basic extra
Atari 800	£300	6502	1.8	48K		40×24	Tv(M+)	●	320×192	W	3						7	4	●	Cassette	Ba	●	A5	Versatile, good graphics
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80×24	TvM			W	8	●	1	1		2	3		2×500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80×24	M			W	26	●	1	1					3×163K5¼F	BOS	Ba	●	C1	Hard disc promised
Basis 108	£1,683	6502	1	64K	126K	80×24	TvM	●	820×168	W	15	●	1	1			6	●				●	C12	Apple bus, Z80, 80 columns
BBC Micro Model A	£299	6502	1.8	16K	32K	40×30	Tv(M+)	●	320×256	W	10					1		●		MOS	BaAs	●	A1	Upgradable to Model B
BBC Micro Model B	£399	6502	2	32K		80×30	Tv(M+)	●	640×256	W	10			1		5	3	●		MOS	BaAs	●	A1	Versatile and expandable
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80×25	M	●	640×200	W	15	●	1					●	2×340K5¼F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80×24	M		80×24	W	14	●	1	1					2×350K5¼F	CP/M		●	B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80×24	M			W	14	●	1	1						CP/M, MP/M, MS-DOS		●	B2	Z80 for 8 bit software
Britannia Baby	£2,657	8085	6.14	64K		80×25	Tv(M+)		80×25	W	11	●	2	1					2×500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included
British Micro Mimi 803	£1,720	Z80A	4	64K		80×25	(M+)		512×256	W	17	●	1	1		1			2×400K5¼F	OS/M		●	B4	This is CP/M compatible
C-1010	£4,197	6502	1	64K	128K	80×24	TvM		256×192	W	12	●	1	1		1	8	●	1×1405¼F+1×10MbH	CP/M, DOS, UCSD-P	Ba	●	C2	Apple II compatible
CAL PC	£2,294	8088	5	128K	256K	80×25	TvM	●	256×512	W		●	2	1		1	5		2×400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor
Caltext Micro	£2,019	Z80A	4	64K	256K	80×24	TvM			W	36	●	1	1			3		2×400K5¼F	CP/M		●	C3	Range of software included
Camputers Lynx	£225	Z80A	4	48K	192K	40×24	Tv(M+)	●	248×256	W			1	1				●		Cassette	Ba	●	C5	Unusual — promise of CP/M
Canon AS100	£2,633	8088	4	128K	512K	80×25	M	●	640×400	W	12	●		1			4		2×640K5¼F			●	C4	Choice of CP/M86 or MS-DOS
Canon CX-1	£2,500	6809	4	128K	256K	80×24	M		80×25	W	15	●	3	1	1		2		2×320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20×1	LCD			C								●		Cassette	Ba		C6	Pocket computer
Casio PB100	£50	Cust.		0.7K	1.7K	60×1	LCD			C		●					1	●		Cassette	Ba		C6	Business pocket computer
Casu Mini C2	£2,300	Z80A	4	64K		*	(M+)		*	*			4	1			6		2×1Mb8F			●	C7	*Choose your own terminal
Cifer Series 1	£3,214	Z80	4	128K	320K	132×32	TvM			W	40	●	3	1					2×800K5¼F	CP/M		●	C17	Other models available
Clenlo Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)		*	*			2	2			18		2×600K8F	CP/M	Ba	●	C8	*Choice of terminal
Clenlo Table-Top 925	£3,105	Z80A	4	64K	128K	80×25	M			W	11	●	2	2					2×600K8F	CP/M		●	C8	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80×24	M	●	640×200	W	10	●	2	1			8		2×320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£170	6502	1	5K	32K	22×23	Tv(M+)	●	176×158	W	8					3	1	●		Kernal	Ba	●	C9	Very popular home micro

Commodore 64	£345	6510	1	64K		40×25	Tv(M+)	●	320×200	W	8					3		●			Kernal	Ba	●	C9	Good value for money
Commodore 500	£799	6509	1	128K	896K	40×25	Tv(M+)	●	320×200	W	10	●	1		1	3	1	●			Kernal	Ba	●	C9	Available by summer?
Commodore 4016	£632	6502	1	16K	32K	40×25	TvM			W		●			1	1	3	●			Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 710	£1,144	6509	2	128K	896K	80×25	TvM			W	10	●	1		1	2	1	●			" Kernal	Ba	●	C9	Might be a long wait
Commodore 8032	£1,129	6502	1	32K	96K	80×25	TvM			W		●			1	1		●			Cassette, PETDOS	Ba	●	C9	The 80-column PET
Commodore 8096	£1,374	6502	1	96K		80×25	TvM			W		●			1	1		●			Cassette, PETDOS	Ba	●	C9	Fully expanded PET
Commodore Super Pet 9000	£1,719	6502	2	96K		80×25	TvM			W		●	1		1	1	2	●			Cassette; PETDOS	Ba	●	C9	Top of the range
Compucorp 675	£6,780	Z80	4	64K	256K	80×20	M			W	20	●	1				4			2×655K5¼F	Compucorp		●	C10	Unusual O/S
Compustar	£5,837	Z80A	4	64K		80×25	M			W		●	2							1×10Mb8H+1×350K5¼F	CP/M	Ba	●	I10	Networking system
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80×24	M			W		●	2	1			10			2×390K5¼F	CP/M		●	C13	Business CP/M micro
Comx 35	£120	1802		35K	67K	40×24	Tv	●		C								●			Cassette	Ba		C14	Built-in joystick
Cortex	£454	9995	12	64K	1Mb	40×24	Tv(M+)	●	256×192	W	12	●	1					●				BaAs		M2	Mainly sold as £340 kit
Corvus Concept	£4,887	68000	8	256K	1Mb	120×60	M		720×560	W	10	●	2			1	4				Merlin	Pa	●	K1	A4 shaped screen
Country Computers C1000	£4,542	6502	1	64K	128K	80×24	M		280×192	W	12	●	1				3			1×10Mb5¼H+1×140K5¼F	DOS, CP/M	Ba	●	C16	Runs all Apple software
Country Computers C3000	£2,242	Z80A	4	64K	256K	"	"			"			1	1						1×5Mb5¼H+1×500K5¼F	CP/M		●	C16	*Terminal own choice
CP1100	£2,639	8086	6	128K	1Mb	"	(M+)*			"			2	1			7			2×390K5¼F	CP/M 86		●	C13	Choose your own terminal
Cromemco System 1	£3,025	Z80	4	64K		80×24	(M+)	●	450×735	W	20	●	1				8			2×390K5¼F	CDOS, Crom		●	C13	Designed for business
Cromemco System 2	£3,560	Z80	4	64K		80×25	(M+)			W	20	●	1				21			2×390K5¼F	CDOS, Crom		●	C13	Large business machine
Cromemco System 3	£5,170	Z80	4	64K		80×25	(M+)			W	20	●					21			2×1.2Mb8F	CDOS, Crom		●	C13	Top end Cromec
DAI PC	£684	8080	2	48K		60×24	Tv(M+)	●	255×335	W			1					●			Cassette	Ba		D9	Optional maths chip
Datac Micro Controller	£431	Z80	2	16K		40×24	Tv(M+)		80×60	W			1		1	1	●					Ba	●	D1	Mainly used in labs
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132×24	M	●	960×240	W	20	●	2				3			2×400K5¼F	CP/M		●	D2	Competitor for IBM PC
DEC PC 325	£3,080	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				1			2×400K5¼F	P/OS		●	D2	Mini in micro clothing
DEC PC 350	£3,850	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				4			2×400K5¼F	P/OS		●	D2	Mini in micro clothing
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*			*			3	1		1				2×400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*			*			3	1		1				1×400K5¼F+1×5Mb5¼H	CP/M	Ba	●	I2	*You choose the terminal
Diablo 3000	£7,250	8085	3	32K	64K	80×24	M			W	8	●	1				4			2×1.8Mb8F	DACL	Ba	●	B5	Unusual O/S
Digico Prince	£3,392	Z80A	4	64K		80×25	M			W	50	●	2				7			2×400K5¼F	CP/M		●	D3	Unusual keyboard
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*			*			3			1				2×512K8F	CP/M		●	D4	*Choice of terminal
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*			*			4							2×512K8F	MP/M		●	D4	*Depends on terminal chosen
Direct 1000	£3,093	Z80	4	64K		80×25	M		132×28	W			2							2×300K5¼F	CP/M		●	D5	Standard CP/M machine
DMS Fox	£2,875	Z80A	4	64K		80×24	M			W	16	●	3	1		1				1.2Mb5¼F	CP/M		●	D4	Portable machine
Dragon 32	£200	6809E	1	32K	64K	32×16	Tv(M+)	●	256×192	W				1		4	1	●			Cassette	Ba		D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80×64	Tv(M+)			W		●	4			1	12			2×1Mb5¼F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80×24	M		80×24	W		●	2	1		1				2×500K5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle III	£2,950	Z80A	4	64K		80×24	M		80×24	W		●	1							2×1Mb5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle IV	£4,190	Z80A	4	64K		80×24	M			W		●	2	1		1				1×1Mb5¼F+1×12.5Mb5¼H	CP/M	Ba	●	M3	Includes WP/SS software
Eagle 1600	£6,497	8086	8	128K	512K	80×25	M	●	720×352	W	24	●	2	1		1	8			1×1Mb5¼F+1×12.5Mb5¼H	MS-DOS, CP/M 86		●	M3	High speed IBM copy
Enterprise 1000	£2,645	*	8	64K			M			W	10	●	2			2				2×358K5¼F	Enterprise		●	D7	Micro Nova 16-bit
Epson HX20	£472	6301	1	16K	32K	20×4	LCD		120×32	W	13	●	2				2	●			Cassette	Ba		E2	Powerful portable
Epson QX10	£1,995	Z80	4	192K	256K	80×25	M		640×400	W	18	●	1	1			5			2×320K5¼F	CP/M	Ba	●	E2	Expansion required for Valdocs
Equator	£6,842	Z80A	4	64K	448K	80×24	M		255×560	W	14	●	7	1		1	8			1×5Mb5¼F+1×750K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available
Facit 6520	£2,645	Z80	4	64K	128K	80×24	M		80×24	W	8	●	2							2×320K5¼F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80×24	M	●	1024×1024	W	16	●	1				20			2×800K5¼F	Unix		●	I3	Genuine 16-bit
Fujitsu FM8	£1,150	6809	1	64K		80×25	(M+)	●	640×200	W	10	●	1	1		4	1	●			Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80×25	M		800×400	W	20	●	2			2				2×800K5¼F	CP/M 86, MS-DOS		●	E1	Still on a promise
Genie I	£330	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W			1	1			1	●			Cassette	Ba	●	L2	Compatible with TRS 80/I
Genie II	£299	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W	4	●	1				1	●			Cassette	Ba	●	L2	Speeded-up Genie I
Genie III	£1,897	Z80A	3.2	64K		80×24	M		160×72	W	8	●	1	1		1	3			2×700K5¼F	New DOS	Ba	●	L2	CP/M costs extra
Colour Genie	£168	Z80	2.2	32K		40×24	Tv(M+)	●	160×96	W	8		1	1		2	1	●			Cassette	Ba		L2	Home games machine
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80×25	M		160×75	W	10	●	1	1		1	5	●		2×400K5¼F	CP/M		●	G1	Low cost British system
Globe 101	£1,850	8085	3	64K		80×24	M			W	20	●	3							2×325K5¼F	CP/M		●	G4	Wordstar plus Mail Merge inc.
Hawk Model 110	£2,070	Z80A	4	64K	256K	"	(M+)*	●	"	*			2	1			3			2×390K5¼F	CP/M, MP/M2		●	L6	*Choose your terminal
Hawk Model 2110	£5,405	Z80A	4	64K	256K	"	(M+)*	●	"	*			2	1			3			1×390K5¼F+1×21MbH	CP/M, MP/M2		●	L6	*Choose your terminal
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80×25	M		64×255	W	34	●	2				8			2×320K5¼F	CP/M	As	●	H1	Designed for network

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Haywood Hinet	£10,982	Z80	4	64K	128K	80×24	M			W	34	●	3	1		1			1×11Mb8H	CP/M		●	H1	Large network machine
HP 75C	£883	Cust.	N/A	16K	24K	32×1	(M+)			C						1	4	●	1.3K card reader	HP	Ba		H2	Calculator/computer
HP 85	£2,360	Cust.	N/A	16K	32K	32×20	M		255×191	W	8	●	1			4	4	●	Cassette	Ba	●	H2	Engineers' machine
HP 86A	£1,541	Cust.	N/A	64K	512K	80×24	M		544×240	W			1	1		2	4			HP DOS	Ba	●	H2	CP/M optional
HP 87XM	£2,571	Cust.	N/A	128K	640K	80×24	M		544×240	W	14	●	1	1	1	3	4			CP/M	Ba	●	H2	Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80×24	M		80×24	W	8	●	2			1				HP		●	H2	Top end HP business system
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80×25	M			W	5		1		1		2			HP		●	H2	Genuine 16-bit
Hytech H4500	£4,310	Z80	4	64K	208K	80×25	M		80×25	W	26	●	1				3		2×403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80×25	(M+)	●	640×200	W	10	●		1			5		1×360K5¼F	MS-DOS	Ba	●	I9	Slow but reliable
ICL PC Model 10	£2,754	8085	3	64K	256K	80×24	Tv(M+)			W	11	●	2				8		2×700K5¼F	CP/M	Ba	●	I4	Repackaged Rair Black Box
ICL PC Model 31	£4,939	8085	3	128K	256K	80×24	(M+)		80×24	W	11	●	4				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Multi user Black box
ICL PC Model 32	£6,037	8085	3	256K		80×24	(M+)		80×24	W	11	●	8				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Top of ICL range
IDS Datamachine	£1,995	Z80	4	64K	1Mb	*	Tv(M+)		*				2				15		2×400K5¼F	CP/M	Ba	●	I8	*Depends on terminal
IO Tech Iona	£2,539	Z80	4	69K	960K	80×24	M	●	160×75	W	12	●	1	1			8	●	2×400K5¼F	CP/M		●	I5	Good colour versatility
Irvine Business Systems	£1,489	Z80	4	64K		80×25	M			W		●	2						2×400K5¼F	CP/M		●	I6	Inexpensive CP/M machine
ITT 3030	£3,105	Z80A	4	64K	256K	80×24	Tv(M+)		80×24	W	8	●	1			1	1		2×280K5¼F	CP/M, BOS		●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32×24	Tv(M+)		64×46	C		●					1	●		Fr			J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80×24	Tv(M+)		80×24	W	10		1						2×250K5¼F	Kalamazoo		●	K3	Only Kabol language
Kaypro II	£1,949	Z80	4	64K		80×24	M			W		●	1	1					2×200K5¼F	CP/M	Ba	●	C15	A portable business machine
Kemitron K2000E	£2,242	Z80	4	64K		80×24	(M+)		80×24	W			2	1			11		1×300K5¼F	CP/M		●	K4	Scientific Keyboard
Kemitron K3000	£3,795	Z80	4	64K	256K	80×24	(M+)		80×24	W		●	2				14		2×1Mb8F	CP/M, MP/M		●	K4	For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M		●	K5	British portable
Kenilworth 83N	£2,012	Z80	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M	Ba	●	K5	Includes Basic
Kontron RSI 80	£3,306	Z80	4	64K	128K	80×25	M		256×512	W	16	●	2	1			8		2×303K5¼F	Kontron	Ba	●	K6	O/S CP/M based
LSI M3	£2,064	Z80	2.5	64K		80×24	M		80×24	W	31	●	1	1					2×200K5¼F	CP/M		●	L3	Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80×24	M		160×72	W	31	●	2	1			1		2×400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80×24	M	●	640×288	W	12	●	1	1			4		2×1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24×80	M		24×80	W	8	●	4				12		2×1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Micro Five 1000	£5,175	8088	8	128K	512K	25×80	TvM		512×512	W	20	●	10				2		2×1Mb5¼F+2×8.3Mb5¼H	*		●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25×80	TvM		512×512	W	20	●	5				3	●	1×10Mb8F	*		●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80×24	(M+)		*				2						1×200K5¼F	CP/M	Ba,Pilot	●	I2	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80×24	TvM		80×24	W	21	●	1	1					2×160K5¼F	CP/M		●	M4	'Genius' by nature?
Microtan 65	£389	6502	1	8K	48K	25×64	(TvM+)			W		●	1	2				●		Tanbug	Ba	●	M8	Expandable in many ways
Millbank SX10	£2,754	Z80A	4	65K	256K	80×25	M		80×25	W	10	●	2			1			2×350K5¼F	CP/M	As	●	M5	Scientific applications
Molecular M200	£5,462	Z80	4	64K	320K	*	(M+)*						2			1	16		1×10Mb8H+1×500K8F	CP/M	BaAs	●	G2	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40×24	M		240×240	W	32	●	3			3			1×320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80×24	M		80×24	W	32	●	3			2	1		1×320K5¼F	Monroe	BaPa	●	F3	Bigger model available
Multitech MPFII	£269	6502	1.2	64K		40×24	Tv(M+)	●	280×192	C					1	1	1	●		Cassette	Ba	●	S8	Apple soft compatible
Nascom 2	£327	Z80A	4	2K	64K	16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Old reliable
Nascom 3	£549	Z80	4	48K		16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Fully expanded Nascom
NEC PC8000	£1,454	Z80	4	32K	64K	80×25	M	●	160×100	W	10	●	2	1					2×300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
New Brain A	£269	Z80A	4	32K	512K	80×30	Tv(M+)		640×220	C			2				1	●		Cassette	Ba		G3	A lot of promise
North Star Advantage	£2,766	Z80	4	64K		80×24	M		640×240	W	15		1				6		2×360K5¼F	CP/M		●	T9	16-bit option
North Star Horizon	£2,294	Z80	4	64K	512K		*		*	*			2	1		1	9		2×360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal
OEM Orion	£3,392	8086	8	128K	896K	80×25	TvM		800×400	W	13	●	11				6		2×500K5¼F	CP/M 86	BaCo	●	O5	*Full communications machine.

Olivetti M20D	£2,754	Z8000	3	160K	512K	80×25	M	●	512×256	W		●	1	1			5		2×320K5¼F	PCOS	Ba	●	B6	Real 16-bitter
Olympia Boss Model A	£2,645	Z80A	4	64K		80×28	M	●	80×28	W	10	●	1				4		2×140K5¼F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K	"			"	"			5	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	*Terminal extra; other models
Oric 1	£139.95	6502A	1	48K		40×28	Tv(M+)	●	240×200	C				1		1		●		Cassette	Ba		O2	16K promised
Osborne 1	£1,581	Z80	4	64K		52×24	M		128×32	W	10	●	1		1				2×185K5¼F	CP/M	Ba	●	O3	Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K		80×24	M		80×24	W	21	●	3	.					2×250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80×24	M			W		●	1	1					2×250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K		"	"		"	"			4				8		2×1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra
Pied Piper	£1,226	Z80A	4	64K		80×24	Tv			W	36				1		1		1×1Mb5¼F	CP/M			S11	Incl. four software packages
Philips P3500	£3,000	Z80A	4	64K	320K	80×25	M			W	11	●	2						2×0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard
Positron 900	£1,259	6809	1	64K	256K	"	(M+)		"	"			4		1		3			O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80×24	TvM	●	480×240	W	12	●	4		1		3			O/S 9	Ba	●	P4	Multi user version
Quantum 2000	£2,587	Z80A	4	64K	192K	80×25	M		160×75	W	18	●	1	1			5	●	3×860K5¼F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80×24	(M+)		"	"			2				8		2×1Mb5¼F	CP/M	Ba	●	R1	*VDU extra; many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80×25	M	●		W	10	●	2			4	8		1×19Mb5¼H+1×1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80×26	M		80×26	W	21	●	1	1					1×600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40×24	Tv(M+)			W			1	1			4	●	2×144K5¼F	CP/M	Ba	●	R3	Widely used in schools
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40×24	Tv(M+)			W	4		2	1		1	2	●		Cassette	Ba		R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K	"	(M+)		"	"			2	1	1				2×640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra
Sage IV	£5,962	68000	8	128K	1Mb	"	(M+)	●		"			6	1	1				2×640K5F+1×6MbH5¼	UCSD-P System	PaBaFn	●	T10	*Terminal own choice
Samurai	£3,214	8086	4.6	128K	768K	80×25	M	●	720×400	W		●	3	1			3		2×1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80×25	M		80×25	W	17	●	1	1					1×320K5¼F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80×40	M		640×400	W		●	1	1					2×640K5¼F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80×24	M		80×24	W	24	●	2	1			2		2×328K5¼F	CP/M	Ba		L1	Big disc model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80×24	M		80×24	W			1	1					2×640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80×24	M		80×24	W	3	●	2				8		2×160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M			W	3	●	2				8		2×160K5¼F	OS-9		●	S3	Latest from Seed
Sharp MZ80A	£549	Z80	2	48K		40×25	M		80×50	W		●						●		Sharp Basic	Ba	●	S4	CP/M facility extra
Sharp MZ80B	£900	Z80A	4	64K		80×25	M		320×200	C	10	●						●		Sharp Basic	Ba	●	S4	Unusual keyboard
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24×1	C	18	●					1	●		Sharp Basic	Ba		S4	Pocket computer
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26×1	LCD		156×7	C	6	●	1	1			2	●		Cassette	Ba		S4	Optional 4-pen plotter
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M		160×50	W	10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic
Signet 10025	£1,599	Z80B	6	64K		80×24	M	●	512×512	W		●	2	1			1		2×200K5¼F	CP/M, Macnos		●	S9	Choice of keyboards
Signet 2	£1,483	Z80	4	64K		80×24	(M+)	●	512×256	W	18	●	2						2×200K5¼F	CP/M			S9	Multi-user system
Sinclair ZX81	£40	Z80A	3.5	1K	16K	32×24	Tv		64×44	C								●		Cassette	Ba		S5	Sold a million
Sinclair Spectrum	£99	Z80A	3.5	16K	48K	32×24	Tv	●	256×192	C								●		Cassette	Ba	●	S5	Very popular home micro
Sirius I	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£150	Z80A	4	4K	16K	40×24	Tv(M+)	●	256×196	C					1	2		●		Cassette	Ba		S6	Japanese home computer
Sord M23	£1,932	Z80A	4	128K		80×25	M	●		W	14	●	2	1		2	3		2×330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	●	640×200	W	14	●	2	1		2	2		2×290K3½F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80×25	M			W		●	2			4			2×350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80×25	M	●	640×400	W	15	●	4	1		4			2×1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80×24	M			W	15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex			S7	Top end SWTP
Spectrum	£11,442	68000	8	256K	4Mb	"	(M+)		"	"			4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M			W		●	5	1				●	1×14Mb5¼H	BOS			T2	Tape backup for hard disc
Superbrain JR	£2,127	Z80A	4	64K		80×24	M		560×240	W		●	2			1			2×160K5¼F	CP/M	Ba	●	I10	Bigger models available
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)		80×24				1	1		8			1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk
Tandberg EC10	£3,000	8080A	2	64K		80×25	M			W		●	7						1×250K8F	CP/M, TOS	Ba	●	T3	Very early machine
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M		80×24	W	2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T4	Big business machine
Tandy TRS-80 Model III	£1,299	Z80A	2	48K		64×16	M		128×48	W		●	1	1		1		●	2×184K5¼F	TRS-DOS	Ba	●	T4	Latest TRS80
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M			W	2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32×16	Tv	●	256×192	W			1					●		Cassette	Ba	●	T4	Very popular
Tandy TRS-80 PC4	£50	Cust.	N/A	½K	1½K	12×1	LCD		12×1	C	9	●			1	1				Cassette	Ba		T4	Low-cost pocket computer

HARDWARE

Make and model	Price inc VAT	Processor type	Speed (MHz)	Standard RAM	Max RAM - normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Tandy TRS-80 Pocket Computer 2	£130	Cust.	1.3	2.6K	16K	26×1	LCD		156×7	C	6	●						●		Cassette	Ba		T4	Plotter available
Televideo TS-802H	£4,533	Z80	4	64K		80×24	M		80×24	W	15	●	2			1			1×256K5¼F+1×7Mb5¼H	CP/M		●	C11	Recently upgraded
Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M		80×24	W	15	●	2			1				CP/M		●	C11	Standard CP/M machine
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80×24	M		576×424	W	15	●	2			1			2×256K5¼F	CP/M-86		●	C11	Graphics, but no colour
TI Professional Computer	£2,386	8088	5	64K	256K	80×25	M			W	12	●		1					1×320K5¼F			●	T5	Choice of operating systems
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32×24	Tv(M+)	●	256×192	W						2		●		DOS	Ba	●	T5	This has sprite graphics
TI System 200-250	£6,695	9900	4	64K		80×24	M		80×24	W	12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T5	Bigger version available
TMK 332	£2,242	8085A	5	64K		80×24	M		190×96	W	22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	●	640×256	W	15	●	1	1		4		●	2×400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	●	640×200	W	8	●	1	1	1	2			2×256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M		80×24	W	15	●	1		1				2×256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM		640×288	W			2	1		1	5		2×190K5¼F	CP/M		●	T7	S-100 machine
Transtec BC2	£1,949	Z80A	4	64K	256K	80×24	M		80×24	W	13	●	2	1			8		2×386K5¼F	CP/M		●	T8	Fully definable characters
Triton 4	£5,744	Z80A	4	64K	160K	80×24	M			W	8	●	1	1			3		2×1.2Mb8F	MPSL-BOS		●	T11	Upgradable to Winchester disk
Vector 4	£3,852	8088	5	128K	256K	80×24	M	●	640×312	W	15	●	1	1		1	2		2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wicat 150	£6,846	68000	8	256K	1.5Mb	80×25	M		400×300	W	20		2	1			1		2×616K5F	MCS	Ba	●	S10	Upgradable to 32 user system
Wilkes YPD8110	£4,025	8086	5	128K	896K	80×24	M	●	960×624	W	21	●		1			6		2×1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
Xerox 820 Model II	£2,415	Z80A	4	64K		80×24	M		1024×512	W		●	2	2			2		2×160K5¼F	CP/M		●	R4	Powerful graphics
Zenith 120-22	£2,978	8088	5	128K	192K	80×25	M		640×225	W	18	●	2	1	1	1	5		2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80×24	M			W		●	2	1					1×100K5¼F	CP/M	Ba	●	Z1	Elderly CP/M machine
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)		80×25	W	11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

DISTRIBUTORS

A1 Acorn Computers, Cambridge 245200 **A2** Adds (UK) Ltd, 01-949 1272 **A3** Ads Ltd, 01-947 4881 **A4** Almarc Data, Nottingham 52657 **A5** Atari International (UK), Slough 33344 **A7** ACT, 021-454 8585 **A8** Apple Computers, Hemel Hempstead 60244 **A9** Anderson Jacobson Ltd, Slough 25172

B1 Barcelios Ltd, Leicester 541574 **B2** Bonsai, 01-580 0902 **B3** Britannia Computer Ltd, Dudley 233433 **B4** British Micro, Watford 48222 **B5** Business Computers Ltd, 01-207 3344 **B6** British Olivetti, 01-785 6666 **B7** Bromley Computer Consultancy, 01-697 8933

C1 Computer Pheripherals Ltd, 01-278 7837 **C2** Country Computers Ltd, Redditch 29826 **C3** Computer Ancillaries, Egham 36455 **C4** Canon (UK) Ltd, 01-680 7700 **C5** Camputers Lynx, Cambridge 313063 **C6** Casio, 01-450 9131 **C7** Casu Electronics Ltd, Uxbridge 72511 **C8** Cienlo Computing Systems, 01-670 4202 **C9** Commodore Business Machines, Slough 79292 **C10** Compucorp, 01-907 0198 **C11** Colt Computer Systems, 01-577 2686 **C12** Community Computers, Petersfield 87567 **C13** Comart, Huntingdon 215005 **C14** Computers For All, Baildon 418414 **C15** CK Computer, Plymouth 780311 **C16** Country Computers, Redditch 29826 **C17** Cifer, Melksham 706361

D1 Datac, 061-941 2361 **D2** Dec Ltd, Basingstoke 59200 **D3** Digico, Letchworth 78172 **D4** Digital Microsystems, Reading 343885 **D5** Direct (UK), Warrington 814072 **D6** Dragon Data Ltd, Kenfig Hill 744700 **D7** Data General, 01-572 7455 **D8** DRG, Weston-Super-Mare 415398 **D9** Data Applications, Cirencester 61828

E1 Encotel Systems, 01-686 9687 **E2** Epson (UK), 01-902 8892 **E3** Equinox, 01-739 2387

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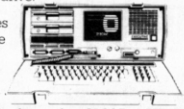

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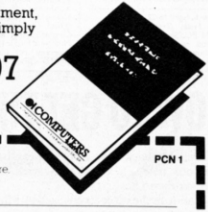

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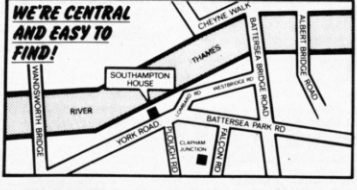

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BACK ISSUES

Issue 1, March 11-18.
Pro-Tests: Apple's Lisa, Texe TX8000; Spectrum speech synthesiser, Apple printer, Commodore network; 3D on Spectrum, graphs package for Apple and IBM, BBC graphics system.
Features: computer chess, Occam parallel processing language, Vic-ter/Sirius function keys.
ProgramCards: Towers of Bramah (Pascal), Biorhythm (Apple II), Roman Year (Apple II), Shape Utility (Apple II).
Gameplay: Darts, Soccer (Atari); Castle of Riddles (BBC Model B): Pimania (Spectrum); Flight Simulator (IBM PC).
Databases: micros and peripherals.

Issue 2, March 18-25.
Pro-Tests: Toshiba T100, Casio PB100, ZX81/Basicare, Vic speech synthesiser, Spectrum spreadsheet, IBM graphics, BBC word processing.
Features: Colecovision, micro backgammon, nursery computing.
Gameplay: Ultima II (Apple), Trader (ZX81), Starquest (Vic 20), Hungry Horace (Spectrum).
ProgramCards: String editor (Spectrum), Analogue Clock (BBC Model B), Chart generator (Spectrum), String extract/replace.
Databases: full software listings.

Issue 3, March 25-April 1.
Pro-Tests: TI Professional, Apple speech synthesiser, Facit 410 printer, IBM keyboards, Petspeed compiler, Sirius toolkit, Dragoncalc.
Features: Atom upgrade, Lynx programming, Apple music.
Gameplay: Mangrove (Vic 20), Mutant Herd (Vic 20), Compendium (Dragon), Patience (Spectrum), Noughts and Crosses (Dragon), Great Britain Ltd (Spectrum), Ulysses (IBM PC).
ProgramCards: Magnify (Spectrum), Spider (Vic 20), Firing Range (BBC).
Databases: micros.
Micropaedia: Anatomy of the BBC, part 3.

Issue 4, April 1-8.
Pro-Tests: Pied Piper Communicator, Olympia ESW3000 printer, Namal Supertalker, Commodore-Calcresult, Spectrum Pascal, Cashbook (BBC).
Gameplay: Dark Crystal (Apple II), St George (Dragon), Wizard War (Dragon).
ProgramCards: Fruit Machine (C64), Tunesmith (Oric), Array Editor.
Databases: peripherals.
Clubnet: Clubs and user groups.
Micropaedia: Go Forth, part 1.

Issue 5, April 8-15.
Pro-Tests: Commodore 700, Ikon Hobbit, 1-2-3 (IBM), ZX81 machine code.
Features: speech packs, monitors.
Gameplay: Grand Prix (Dragon), Derby Day (Spectrum), Deadline (Apple).
ProgramCards: Wacky Racers (Oric), Fruit Machine (C64), Parse Integer.
Databases: Software.
Clubnet: full list of user groups.
Micropaedia: Go Forth, part 2.

Issue 6, April 15-22.
Pro-Tests: Tycom Microframe, IBM PC, Scorpio Disks, Dragon sound module, ZX81 graphics, Bottom Line Strategist (CP/M), PaperClip word processor.

Issue 7, April 22-29.
Pro-Tests: Mattel Aquarius, Epson FX80, Olivetti JP101, Lisp on Spectrum, Vic 20 assembler, Supergraf on Victor/Sirius.
Features: Dealer support, Atari graphics.
Gameplay: Krakit (ZX81), Cruising On Broadway (Spectrum), Kaktus (Vic 20), Fantastic Voyage (ZX81).
ProgramCards: CBM controls, Computer Set Up (BBC), Wacky Racers (Oric), Indian Dates.
Databases: Peripherals.
Micropaedia: Graphics part 2.

Issue 8, April 29-May 6.
Pro-Tests: Atari Home Files Manager, Kobra's Vic Stat for the Vic 20, Hestacreat's Accounts for the Spectrum, Epson RX80 printer, NCR's Decision Mate V. Future Computer's FX20.
Features: Micronet, Compact programming on the TI99/4A.
Gameplay: Harvester (Vic 20), Strategic Command (Dragon 32), A first Book of Micro Rhymes (BBC), Telling the Time/Money (Spectrum).
ProgramCards: Program Indexer (BBC B), CBM Database cards 1-4, Sort/Extract.
Databases: software.

Issue 9, May 6-13.
Pro-Tests: Structured Basic on the Apple, Pixel Power on the Vic 20, Star DP5110 printer, Dams and Interpod interfaces for Commodore 64; Micro-Professor.
Features: BBC function keys, Atari word-processing part 1.
Gameplay: Dungeons of Intrigue (Oric), The Castle (Oric), Starship Command (BBC B), Dragon Trek, Nowotnik Puzzle (Spectrum).
ProgramCards: Lower case (Dragon 32), CBM database cards 5-6, Monster (Spectrum), Wildcard Search (MBasic).
Databases: hardware.
Micropaedia: Graphics, part 4.

Issue 10, May 13-20.
Pro-Tests: Infomast on Commodore 64, Dragon Mace; MC202 and CMU800 music synthesisers (Apple), Prism directly coupled modem; Epson QX10.
Features: ZX81 graphics part 1; Atari word-processing part 2.
Gameplay: Rescue (Spectrum), Dictator (Spectrum), Roman Empire (Spectrum), Choplifter (Vic 20), Skyhawk (Vic 20).
ProgramCards: Union Jack (Lynx), Escape (Spectrum), CBM Database cards 7-9, Evaluate (MBasic), Formula (BBC B).
Databases: peripherals.
Micropaedia: Graphics, part 5.

Issue 11, May 20-26.
Pro-Tests: BBC Vufile, PFS:File for IBM, Apple Pascal, printer comparison, Prekard Joystick Controller for ZX81 and Spectrum; CWE Computer Board.
Features: ZX81 graphics part 2, Basic on the Sharp MZ80K.
Gameplay: Motor Mania (Commodore 64), Oric Flight, BBC Music Synthesiser, Music Maker (Spectrum), Embassy Assault (Spectrum), Tobor (Spectrum).
ProgramCards: Homeward Bound (ZX81), Connect Four (Dragon 32), CBM Database, cards 10 — end.
Micropaedia: Keyboards.

Issue 12, May 27-June 2.
Pro-Tests: Spectrum word processor, PFS:Report on IBM. File Handling for Colour Genie; CTI CP80 type I printer, TG Trackball; Sord M5.
Features: Epson Basic, Oric sound part 1, Tandy Colour graphics.
Gameplay: Mad Martha (Spectrum), Frenzy (Spectrum), Headbanger (Spectrum), Oric roundup.
ProgramCards: Election Barchart (Commodore 64), Memory Utility (BBC B), Munch (Spectrum).
Databases: Hardware.
Clubnet: clubs (Cambridge Microcomputer Club special).
Micropaedia: Disk Drives, part 1.

Issue 13, June 3-9.
Pro-Tests: Telewriter for Dragon 32, Abersoft Forth for Spectrum, GPS graphics processing system for Apple II+; joysticks, rulers, Qix.
Features: Epson meets Tandy, Oric music part 2, transferring Basic for Colour Genie and Genie 1.
Gameplay: Everest Ascent (Spectrum), Colour Quest (Spectrum), Micro Maze (Jupiter Ace), Qix (Atari).
ProgramCards: Cupid (Oric), Alien (Dragon 32), Time Bomb (Atari).
Databases: peripherals.

Issue 14, June 10-June 15.
Pro-Tests: Apple Accelerator II board, Modulo-2 (Apple II), Oric-Base, Joystick Control Unit J6, Kempston Centronics Interface. BBC Speech Synthesiser.
Features: Newbrain Basic part 1, Sirius designing.
Gameplay: Ah Diddams (Spectrum), Monopole (Commodore 64), Automonopoli (Spectrum), Dragon dramatics.
ProgramCards: Time Bomb (Atari, cont), Sheep Drive (BBC B).
Databases: Software.
Micropaedia: Spectrum, Part 1

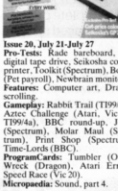
Issue 15, June 16-June 22.
Pro-Test: Comx 35, Address Manager (Spectrum), Syntes (Commodore 64), MST Database (Epson HX-20), Voice Input Module (Apple II).
Features: Newbrain Basic part 2, Genie scene.
Gameplay: Cleared for Landing, Playing the Ace (Apple II), Valtures, Star Jammer (Dragon 32).
ProgramCards: Mower (BBC B), Sprite Clock (Commodore 64), Pirate Island (Atari, 3 of 9), Micro-mind (Colour Genie), Brickbat (Dragon 32).
Databases: Hardware.
Micropaedia: Spectrum, part 2.

Issue 16, June 23-June 29.
Pro-Tests: Atari v Acorn, word processing for the Commodore 64, Simplifile (CP/M), MPF-II printer, Z80 Pack for BBC.
Features: ZX81 Maths, US mail order, Atari graphics.
Gameplay: Computer Scrabble (Spectrum), Education (BBC), Horace and Spiders (Spectrum), Catcha Snatcha (Vic 20).
ProgramCards: Video Titler (TI99/4A 3 of 6), Bowling (Spectrum), Pirate Island (Atari cont).
Micropaedia: Spectrum, part 3.

Issue 17, June 30-July 6.
Pro-Tests: Duet-16, The Organizer (CP/M), Trace and ZX Text (Spectrum), Juki 6100 daisywheel, Video Ultra Term (Apple II).
Features: Leasing part 1, Atari screen action.
Gameplay: Oric chess, Grand Master (Commodore 64), Escape from Orion (BBC), Jet Pac (Spectrum), The Ring of Darkness (Dragon 32), Spectrum spectacle.
ProgramCards: Video Titler (TI99/4A cont), Pirate Island (Atari cont) Word processor (BBC).
Micropaedia: Sound, part 1.

Issue 18, July 7-July 13
Pro-Tests: Tandy 100, RS232 interface (ZX81), ROM pager (Commodore), Interface printer buffer, IBM Personal Basic, Spectrum assembler, Newbrain WP.
Features: Leasing Part 2, Lynx music.
Gameplay: Spectrum Backgammon, BBC Monopoly, Commodore 64 round-up, Serpentine (Vic 20), Psst (Spectrum), Spectrum Safari.
ProgramCards: Word Processor (BBC), Fruit Machine (Spectrum).
Micropaedia: Sound Part 2.

Issue 19, July 14-July 20
Pro-Tests: 16-bit chips, Stock control (Epson HX20), Mailplus (Torch), Smith-Corona daisy-wheel, ZX81 word processing.
Features: Insurance, buying second-hand.
Gameplay: Escape MCP (C64), Escape from Perilous (Atari), Apple round-up, Temple of Apshai (C64), Airline (Spectrum), Heathrow (Spectrum).
ProgramCards: Colour Code (Atari), Wreck (Dragon).
Micropaedia: Sound, part 3.



Issue 20, July 21-July 27
Pro-Tests: Radr barcboard, Vic digital tape drive, Seikosha colour printer, Toolkit (Spectrum), Bonus (Pet payroll), Newbrain monitor.
Features: Computer art, Dragon scrolling.
Gameplay: Rabbit Trail (TI99/4a), Aztec Challenge (Atari, Vic 20, TI99/4a), BBC round-up, Joust (Spectrum), Molar Maul (Spectrum), Print Shop (Spectrum), Time-Lords (BBC).
ProgramCards: Tumbler (Oric), Wreck (Dragon), Atari Errors, Speed Race (Vic 20).
Micropaedia: Sound, part 4.

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Apple II, (64K if possible), + disk drive wanted by teacher in special education to run Logo. Own money so must be reasonable. Tel: 0259 60055 (evenings) or write to St Albert, Child Guidance Centre, 4 Orchard Street, Falkirk.

Spectrum stolen so all software to sell half price. Hobbit, VU-Calc, VU-File, VU-3D, Flight Simulator, Timegate, Dictator, Horace, Machine Code plus books. Tel: 01-701 6855 after 6pm.

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Newbrain Model AD + W/P, Data base, Gobbler (game), printer cable, only five months old, £250 the lot. 69 Trafalgar Street, Ashton under Lyne, Lancs. Tel: 061-344 2051.

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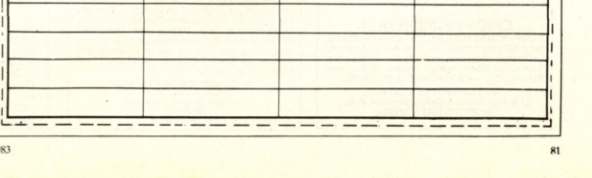

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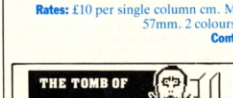

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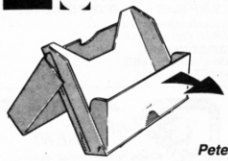

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NEXT WEEK

Zenith rising **— A full PCN Pro-Test of the Zenith Z100 business micro.**
A tale of two mice **— The second part of our examination of the mouse infestation of the IBM PC.**
Sound Spectrum **— How to build your own sound generator for the Sinclair micro.**
Micropaedia **— Part two of a close-up on the Dragon in this week's pull-out supplement.**
Snail trail **— We get on the trail of the new Snail Logo language for the BBC micro.**
Newbrain prospect **— What's at stake in the Grundy collapse? We test the Newbrain CP/M disk system.**

SYNTAX ERRORS

Electron upgrade

In our news story last week about the Acorn Electron (*Extras for the New Baby*, page 2), you may have been given the impression that second processors for the new machine were on the way.

Acorn is in fact expecting to release the second processor system for the BBC micro in November. Our apologies to all would-be Electron owners who thought they were going to get a jump on BBC users by being the first to have a second processor. It'll still be a lengthy process-or.

Price shrinks

In our article on AMS's floppies (*Shrinking disks, issue 25*) we inflated the price. The drives cost £225 and £399, as we stated, but ROM, utilities disk, cables and documentation are included in this price, nót £30 extra.

Bubbly menu

While everybody (ourselves included) has been falling over themselves to tell you what's inside the Electron the real surprise package of Acorn's launch has been overlooked.

It is, of course, the Electron Fizz, a cocktail concocted by Acorn to mark the occasion. *PCN* can now reveal its contents: one-tenth of a bottle of champagne, one-sixth of a gill of a melon liqueur called midori, and one-third of a gill each of brandy and cointreau. Melon balls, whatever they are, are obligatory in the bottom of the glass, whose rim should be frosted with sugar.

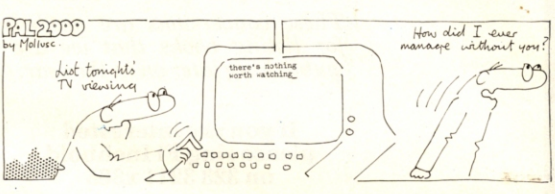
Add-ons like a straw, a swizzle stick, and a miniature parasol are expected from Acorn next month. But you'll have to wait until December for the ice cubes.

Soft William

A national software competition funded by Barclays Bank will yield richer pickings this year — the bank has stumped up 50 per cent more prize money.

It also sent us a list of last year's winners, to show you that real people can actually win this contest. The list is a lengthy one but it has only four girls' names on it. Male domination of microcomputing reaches into the most unlikely places: the winner from Pates Grammar School for Girls, Cheltenham, was William Lumley.

Try ticking the box for no publicity this year, William.



PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

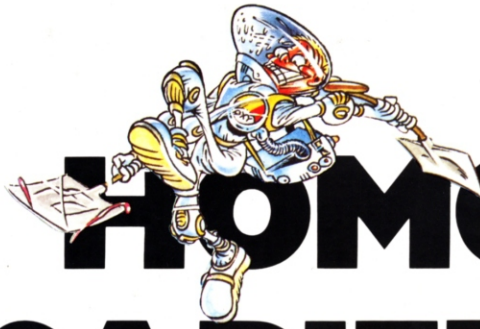
Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
First Hampshire Computer Fair	Sep 8-9	Southampton Guildhall	Testwood Exhibitions, 33/34 Oxford Street, Southampton, 0703 34020
Video, Audio and Computer Show	Sep 16-18	Bradford Exposition Centre	R. Cooper, J. Wood & Sons Ltd, Bradford 720014
BBC Micro User Show	Sep 16-18	Sherwood Rooms, Greyfriar Gate, Nottingham	Database Publications, 061-456 8383
Second National British Osborne Owners' Group Meeting	September 17	National Liberal Club, 1 Whitehall Place, London SW1	Dr J. Anglesea, 021-472 1311 Ext 275
Home Entertainment Show	Sep 17-25	Olympia, London	Montbuild Ltd, 01-486 1951
Kent Apple Village	September 18-21	Stour Centre, Ashford, Kent	Database Publications, 061-456 8383
Computer Open Day Exhibition	September 22	Central Hotel, Glasgow	Couchmead Communications Ltd, 01-778 1102
Microcomputers in Business	Sep 27-29	Warwick University, Coventry	Peter Babb, 01-892 4422
IWP one-day workshop	Sep 29	City Conference Centre, 76 Mark Lane, London EC3	Quadrilect, 3 Courtfield House, Baldwin Gardens, London EC1, 01-242 8697
Personal Computer World Show	Sep 29-Oct 2	Barbican Centre, London	Montbuild Ltd, 01-486 1951
Computer Fair	Oct 2	The Sir Frederic Osborn School, Welwyn Garden City	R Brown Welwyn Garden City 23367

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Australian Computer Exhibition	Sep 13-16	Melbourne, Australia	Riddell Exhibition Promotions PTY Ltd, 166 Albert Road, South Melbourne, Vic 3205
International Peripheral Equipment & Software Exposition Computex	Sep 13-15	Moscone Centre, Anaheim, USA	Cahners Exposition Group SA, 0483 38085
	Sep 20-22	Limerick, Republic of Ireland	SDL Exhibitions, Dublin 763871
Info '83	Oct 10-13	New York, USA	Cahners Exposition Group, 0483 38085
Computer Systems International Trade Fair & Congress	Oct 17-21	Munich, West Germany	ECL Exhibition Agencies, 01-486 1951



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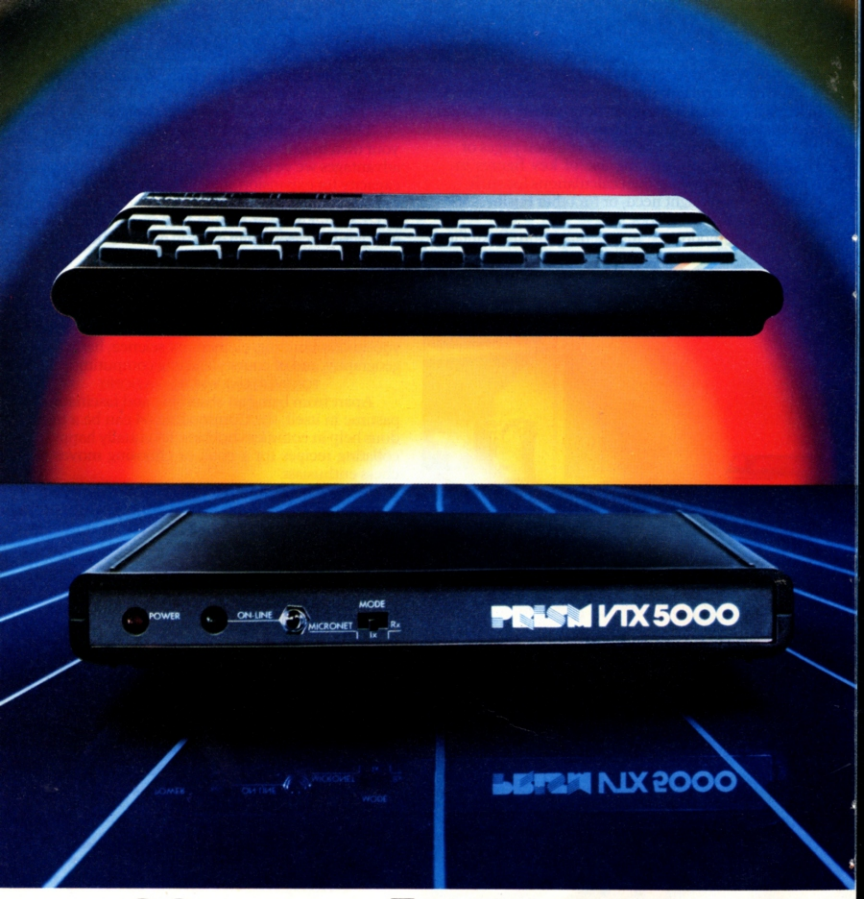

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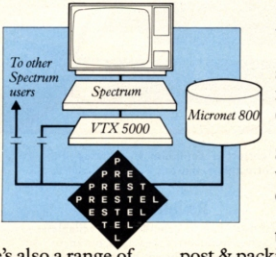

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